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We referred last week to the perfunctory character of the hearings on and discussions of the various measures affecting railways which are pending in Congress. The entire scene presented at Washington is in striking contrast to that presented four years ago when the Hepburn bill was under consideration. The comparatively small amount of keen and intelligent interest being shown is due to a number of causes. There is little public demand for railway legislation at this time. The railways have found that their opposition is more apt to cause than to prevent radical law-making, because politicians usually assume that whatever is bad for the railways is good for the public and that, therefore, when the railways oppose doing a thing it is a sure sign it ought to be done. Consequently, the railways are offering very little concerted opposition to pending measures. More active and vigorous opposition has been offered by the Railway Business Association. This has rather graveled the politicians, who with characteristic simplicity have heretofore been wont to assume that there were only two sides to railway regulation, that of the public and that of the railways. The discovery in their own districts of members of the Railway Business Association, having large numbers of employees, has caused not a few members of Congress to devote more judicious, although perhaps not more disinterested, reflection to the fairness of continually pounding railways than they otherwise would have given to the subject. The ultimate result, no doubt, will be the passage of laws which will be less conservative than what the railways and interests affiliated with them may wish, but less radical than what they have feared.

The press despatches have stated in veiled fashion, but at periods immediately preceding and immediately after the New Haven's settlement with its men, that the latter, as part of the settlement, endeavored to commit the New Haven company to a position favorable to "labor" in case of trouble of the New York Central with its men. The New Haven men had voted to strike—barring a satisfactory adjustment—and the New York Central men were about to vote. Apparently, therefore, the New Haven conductors, trainmen and yardmen tried unsuccessfully to inject into their own negotiations the conditions of an independent corporation, not as bearing on wages, hours or other concrete matters, but as a sentimental force. Stated differently, but not too strongly, the sympathetic strike idea was to be grafted on the corporation itself as against a sister corporation to bring the latter to terms, and the corporation was to be used officially as labor's weapon. If this interpretation is true it introduces us to a new aspect of the arrogance of organized labor. It is not enough to threaten a strike. It is not enough to actually strike with all the injury to corporate and public and private interests that a strike on a public service system implies. But the further step must be taken of a compulsory alliance of the corporation with the union against other corporate interests with which the union happens to disagree. The corporation must not only surrender but must serve in the ranks of the victors. That such a proposition, far outstripping the ordinary sympathetic strike, falls by its own audacity does not disguise it as a symptom of the present temper of organized labor and its waxing spirit of aggression. It is to be noted, however, that a saner counsel prevails among the central officers of the national labor organizations; it is understood that they refused to countenance the stand taken by the New Haven employees.

In the spring the graduate's fancy turns toward thoughts of a job. To the engineering graduate comes the report that all branches of the engineering profession are overcrowded, and one of them writes to ask us if this is true. Our answer is, yes. But the same thing can be said of every business and profession. No escape is possible from severe competition in the lower strata, where the inexperienced start. But while

there is nowhere much room at the bottom, there is plenty of it at the top. This trite saying was never more true than now, nor more true of any profession than the engineering. The young man with an engineering education doubtless has the best preparation for winning success under modern conditions. In the first years of his professional life he is put to work on short notice, laid off without any warning and has frequent and long periods of non-employment. In this respect he is on a plane with the common laborer, and he has little advantage over the laborer in the wages he receives. But industry and ability, combined with his technical education, usually will soon lift him high above the rank of the laborer, financially and otherwise. American railways annually absorb a good proportion of engineering graduates. That a man who enters railway service has had engineering education does not necessarily mean that he will stay in exclusively engineering work. Education means opportunity; and technical training spells opportunity in many different branches of the railway business. Whether a man will stay in exclusively engineering work, or drift into some other branch of railway service, will depend on the man and on conditions; but in either event he will find no lack of opportunity.

THE RAILWAY AS PRESS AGENT.

A few months ago a collision of some seriousness occurred on one of our eastern railway lines. The first telegraphed report of it stated that the engineer at fault had been on duty 59 hours without rest. The facts were otherwise. The engineer had been given his time for sleep and when the collision came was very much awake, or should have been. Within a few hours the operating officers of the company had the exact facts in hand. But no official denial followed hot-foot on the telegraphed misstatement. The truth dribbled out by bits a few days later with no emphasis of big headlines. There was no official statement at all. Some millions of newspaper readers got an impression more or less deep that the railway corporation was overworking its men and endangering its passenger service. And that impression, emphasized in its character by a "human interest" story told on the wires, went to take its place as a unit in the thousand and one impressions, favorable or the reverse, by which the great mass of public opinion for or against the railway corporation was made up. The truth, to be sure, could never have quite caught up with the original error; but it could have heeled the error close and much qualified its evil. The Virgilian Latinism concerning the growth of scandal as it flies rests for much of its force upon whether or not truth is a pursuer.

The special incident expresses, in its limited way, the general truism of the overgrowth of reticence as a railway policy. Silence, in undue extremes, has become the line of action—or, rather, inaction—in the railway office. Nor is it to be denied that, perhaps primarily, the newspaper itself is one cause. There are newspapers and newspapers. Some give railway matters intelligent treatment. They see railway affairs in clear perspective, detect and expunge the absurdity in reportorial "copy," discriminate fact from fiction. But there are other newspapers, unblessed alike with the accurate reporter and with the copy reader "up" in railway circumstance, that run riot in the railway world of visions. Their presses turn off daily their paper product of unrealism which the railway officer cons on the clipping sheet with a sardonic smile. But the smile is unfortunate. It means the transmission to the sensorium of the railway office of the idea that the column of the newspaper is too faulty to be worth attention; that the reading public either does not believe what it reads or forgets quickly what it does believe; and that the better plan is to let the newspapers severely alone. Such a theory easily crystallizes into the chronic reticence with which the railway officer treats the news seeker. Coupled with it often go the too sharp discrimination between things of public interest and railway interest and the theory that what concerns the one does not concern the other. The "mind your own business" is undoubtedly too strong and fast a phrase to describe this attitude. Yet that idea, which a great railway king once accented with profanity, has its savor of fact.

Subject to certain reservations the wiser railway policy lies at the other extreme. Some of the elements of a public interest in the railway, rational, legitimate and intense, are obvious. They are based upon the intrinsic nature of the railway as a public service institution with which the people are in constant contact—or collision. But beyond there is a public interest sentimental, imaginative, poetic. The railway bulks big in public fancy. Its physical vastness, the size of its locomotives, the speed of its fast express, the new bridge or station of magnitude and beauty catch the popular eye outwardly just as the inner eye is caught by the tale of a big railway "deal." From this environment of acute public interest the railway cannot escape if it would. As such does it not become the valid object of "news," to be diverted so far as may be by prudential railway policy from the airy limbo of reportorial fiction to the precisions of official fact?

But, as stated, there are reservations easily found. If there are things to be disclosed there are other things to be covered, for a time at least, with their mantle of secrecy. A railway corporation is planning the purchase of a new line or a merger. The publicity that would thwart or imperil it must, of course, be postponed. An extension is on the blue-prints involving purchase of rights of way. The "news" of it, which would send the rights kiting upward, must wait and can justly wait. So, also, for example, with schemes for operation which, known, would advantage rival interests. In all such cases the railway corporation in compelling secrecy merely follows the analogy of human nature and of the individual. But sometimes, even in those cases and often in others, the railway as a press agency makes the mistake of holding back "news" too long. A good and, indeed, a fundamental rule of action is, when a piece of news is of a nature that must sooner or later disclose itself, to give it out as soon as possible in clear, definite, substantial and official shape. In such case the "news" starts right; it avoids the greater risk of leakage, of half-truth and of sensational treatment flaunted under big type; and though the reportorial pen may add some frills, the body of truth is there. As a bit of practical advice may be added the wisdom of study of the newspaper and of the press association as mechanisms of publication. The railway news that goes out in the rush hours of the editorial room and of the wires habitually suffers as compared with the official statement sent in early.

There has of late years been much comment on corporate publicity by the compulsion of law. Under the shadow of that expansive topic has not the railway manager lost sight of the values of the voluntary publicity that, properly used, may be a genuine railway asset? Has he not too often overlooked the powers of voluntary publicity as a defensive and protective policy and overmuch let corporate reticence harden into an inflexible rule? And is not the best remedy for distorted railway fiction in the press a larger outgiving than now in the form of the official utterance that nails the fact?

NEW BOOKS.

Air Brake Catechism and Instruction Book, including the Westinghouse and New York Air Brakes. By C. B. Conger. Published by the author at 224 South Prospect street, Grand Rapids, Mich. Cloth; 4 in. x 6½ in.; 270 pages. Price, $1.00.

This handbook of instruction on air-brakes is so well-known and has been so favorably received that it is now published in the twenty-fourth edition. All new designs of locomotive and high-duty car brakes of both the Westinghouse and the New York air-brake companies in current use are here explained. The book went to press about the first of February, and it covers all air-brake apparatus in general use at that time. It contains complete explanations, with illustrations, of the dif-

ferent valves as well as the foundation brake for both systems; a new series of questions and answers are given covering the general operation of the brakes. As railways are now requiring most of their trainmen to be informed in regard to the construction and operation of the air-brake, convenient books of this kind will be found necessary, and we know of none which meets the requirements better than does this one.

Letters to the Editor.

THE JAMAICA FLOODS.

Jamaica Government Railway,
Kingston, Jamaica, B.W.I., March 4, 1910.

TO THE EDITOR OF THE RAILWAY AGE GAZETTE:

It may be of interest to your readers to learn that during the floods which prevailed in this island in November last, 135 in. of rain fell in five days. In the 24 hours ending 7 a. m., November 9, 30 in. fell at one station on our line.

FRANK RICHMOND.

A CORRECTION.

Olympia, Wash., March 20, 1910.

TO THE EDITOR OF THE RAILWAY AGE GAZETTE:

We have read with interest your notes on the article by myself in your issue of February 18, and your editorial on the question of the valuation of railways in your issue of March 4. In the editorial you made an error in the mileage of the Northern Pacific in this state which is very material and produces a rate of valuation per mile much in excess of the correct amount. There were also slight errors in the mileages of the other roads. This was probably occasioned by your taking into consideration the branch lines and subsidiary lines included in the valuation of the Northern Pacific, such as the Washington & Columbia River and the Central Washington, which, with other branch lines, brings the total mileage of the Northern Pacific in this state to 1,629.42 miles.* The following table gives the market value, mileage, rate per mile as found by the commission and the amount which you have found:

Road.	Market value.	Mileage.	Per mile.	*Railway Age Gazette*
Great Northern	$59,577,212	770.01	$77,200	$73,900
Northern Pacific	110,308,450	1,629.42	67,800	106,500
Oregon R.R. & Nav.	19,500,000	501.09	39,000	38,900

Without taking issue with you in your editorial, and along the lines of our conversation in your office, we believe that substantial results can be secured by valuation which will harmonize the relationship of the railways and the public and bring about a better understanding on the part of each as to the attitude of the other. I feel that the public good will be subserved by that fair and intelligent work in rate regulation which will save us from the catastrophe of government ownership.

J. C. LAWRENCE,
Member, Railroad Commission of Washington.

FOREIGN RAILWAY NOTES.

The Governor-General of Indo-Chine has announced that through traffic between Yunnanfu and Tonkin was to commence on February 1.

The latest report from Chinese native sources regarding ways and means to raise money for the construction of railways throughout the Chinese empire says the board of posts and communications has proposed the establishment of a lottery with a view to creating a construction fund. So far as has been learned Imperial sanction has not been secured.

*[The erroneous figures were derived from the commission's interesting, but very detailed and often puzzling, "findings of facts."—EDITOR.]

Contributed Papers.

SUBAQUEOUS TUNNELS.*

BY R. B. WOODWORTH,
Engineer with the Carnegie Steel Company, Pittsburgh, Pa.

IV.

THE SHIELD METHOD.

The construction of subaqueous tunnels of large extent through soft materials under the beds of streams without removal of the cover has been made possible by the shield method in connection with the use of compressed air and metallic tunnel lining. It has succeeded where attempts to tunnel by ordinary mining methods with or without compressed air and with the use of brick lining have failed. Consequently it may be looked upon as the most perfect method of subaqueous tunnel construction.

History.—The shield method of driving subaqueous tunnels was invented by Mark Isambard Brunel. This remarkable engineer, born in Brittany, educated for the ministry, trained alike in seamanship, surveying, architecture, timber production and manufacture, inventor of shoemaking machinery, improved copying pens, methods of polishing tin foil, etc., etc., applied to the construction of the Thames river tunnel the best of his skill and experience, and did what the best engineers of his day could not do. The tunnel was first proposed in 1798 by Ralph Dodd, but abandoned. In 1804, under act of Parliament, a tunnel from Rotherhithe to Limehouse was begun when a shaft 11 ft. in diameter was sunk 42 ft. with a view to the commencement of the horizontal excavation. Work was soon suspended, to be resumed with a diameter of 8 ft. in 1807 by the Cornish engineer, Trevithick, and a small heading carried 923 ft., or to within 150 ft. of the opposite shore. Trevithick then made an opening in the top of the heading to test the alinement with the result that he and his party were almost drowned, the heading was filled up and the work abandoned. After various plans had been proposed for the construction of the tunnel it was taken up in 1824 by Brunel, who sunk a new shaft of brick work 50 ft. in diameter, 42 ft. high and 3 ft. thick, built on a metal cutting edge and sinking bodily into the ground by what are now called caisson methods. From this shaft he proceeded with the tunnel, which, when completed, was a brick structure 38 ft. by 22 ft. 6 in., enclosing two horseshoe-shaped tubes 16 ft. 4 in. high by 13 ft. 9 in. wide separated by a 3-ft. 6-in. brick wall, pierced occasionally with openings. The shield was placed in position by January 1, 1826. It consisted of 12 great frames 22 ft. high and 3 ft. wide, made of cast iron with a cutting edge top and bottom and divided into three stories, thus presenting 36 cells or working platforms both front and back for the workmen, namely the miners, by whom the ground was cut down in front and the bricklayers, who simultaneously, with the advance of the shield, placed the brickwork of the finished structure. The leaves of the shield were advanced by powerful screw jacks, and the vertical face was protected by horizontal poling boards which could be handled separately and pushed forward as the ground was excavated. The water broke in several times, impeding the work, to be stopped by bags of clay dumped into the chasm; financial conditions also interfered to delay the completion until 1843, but the shield was a success from the start. It embodied all the fundamentals of the modern type except the tail tube, which came in use with tunnels of circular form.

The annular shield and cast iron lining were first used by James Henry Greathead. Greathead was born in Grahamstown, Cape Colony, on August 6, 1844, came to England in 1859, and in 1864 became a pupil of P. W. Barlow, through

*From a paper read before the Railway Club of Pittsburgh.

whom he became acquainted with the shield method of tunneling. Barlow had a strong belief in the shield and was the author of a scheme to facilitate London traffic by the construction of underground railways running in cast iron tubes built with its aid. To show what the method could do it was resolved to make a subway under the Thames near the Tower, but the trouble encountered by Brunel in the Thames tunnel made engineers hesitate to undertake the subway, though it was of much smaller dimensions—6 ft. 7 in. in diameter (some say 8 ft. 0 in). At this juncture Greathead offered to take the contract and he successfully carried it through without resort to the use of compressed air, which Barlow in 1867 suggested might be employed in water bearing strata. In 1884 Parliament authorized the construction of the City & South London Railway to be worked by the Hallidie system of cable traction. This was begun in 1888 and the tunnel was driven by means of the Greathead shield, compressed air being used in water bearing strata when necessary. During the progress of the work electric traction became so far developed as to be superior to cables and when the line was opened it was an electric one. The railway is 3⅛ miles long entirely underground and consists of two 10-ft. 6-in. cast iron lined tunnels substantially parallel to each other, which converge into a single tunnel at the terminal.

Where Barlow got the idea of lining tunnels with cast iron does not appear. It is significant that coal mine shafts have been lined with cast iron tubbing rings for more than 50 years, and it is more than likely that their use in tunnels is the application to horizontal passages of a method of construction long approved by English and European practice in sinking deep shafts through soft and water bearing strata under difficult conditions, and is but another proof of our preposition that tunneling is essentially a mining operation.

Compressed air was first used in the United States in 1880 by D. C. Haskin in the Hudson river tunnel, where an attempt was made to drive a double track tunnel through the mud and silt with a pilot tube 6 ft. 6 in. in diameter advanced 30 to 40 ft. ahead of the main tunnel, to form a firm support for the iron plates of the latter by means of radial screws. Compressed air at a pressure of 20 lbs. per sq. in. prevented the weight of silt and water from crushing the plating and flowing into the tunnel.

Where open gravel or running sand heavily charged with water are met a diaphragm must be fitted to the shield. Mallet proposed in 1858 to carry in this way a tunnel under the English Channel. The pneumatic shield designed by Sir Benjamin Baker is the outcome of this idea. His shield is supported against external pressure by girders 6 ft. apart. Horizontal shelves of steel plates with cutting edges are spaced about 4 ft. apart, and the face of the shield is closed by vertical plates, slides and doors, so as to admit the materials being excavated, while the compressed air prevents the influx of water. Where firm clay is met the shield plates may be unbolted. When sufficient material has been excavated the shield is advanced by hydraulic pressure and the lining built under the tail of the shield. The Blackwall tunnel, 3,116 ft. long and 24 ft. 3 in. inside diameter, built in 1892 to 1897, was built with a shield 28 ft. 8 in. outside diameter, 19 ft. 6 in. long, with bulkheads, movable shutters and other important features embodied in Sir Benjamin's design. The shield was pushed ahead by twenty-eight 100-ton hydraulic jacks abutting against the cast iron lining, which was placed in position by two hydraulic erectors. This type of shield is that used on the Pennsylvania Railroad tunnels into New York City.

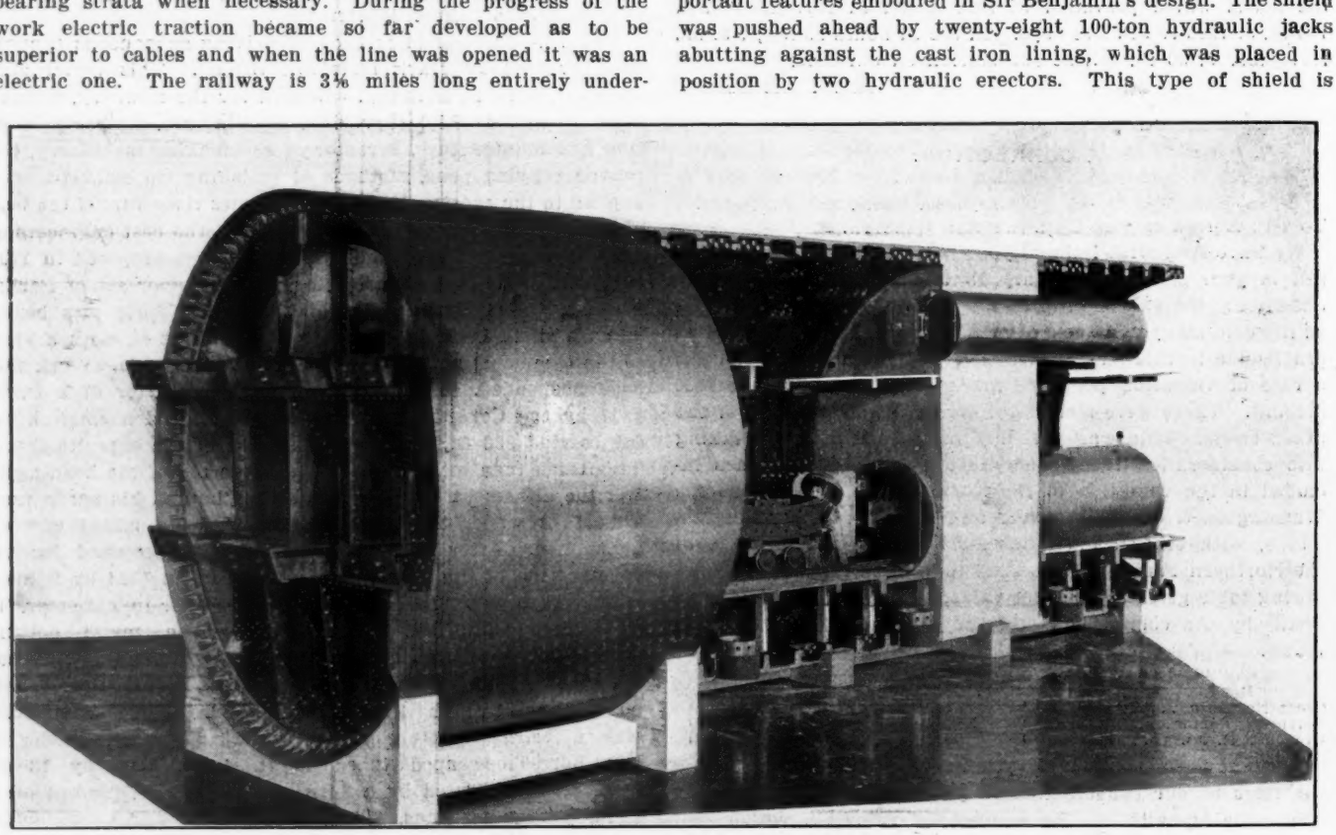

Fig. 11—Front View of Pennsylvania Railroad Tunnel Shield.

Various plans have been suggested for the removal of the material in front of the shield. Mr. Greathead would effect it by a closed current of water carrying the stuff through the shield from front to back. In part of the Hudson tunnel work the shields were driven through mud and silt, plowing it aside.

The first American subaqueous tunnel constructed and completed by the shield method was the St. Clair under the St. Clair river at Sarnia, built inside a cast iron lining, under Joseph Hobson, chief engineer of the Grand Trunk. The shields were 21 ft. 6 in. in diameter and 15 ft. 6 in. long, made of 1-in. steel plates stiffened by five diaphragms dividing it into 12 cells. There were 24 hydraulic jacks, each capable of 125 tons pressure, but the total power used did not exceed 1,800 tons. Each lining ring is 18 in. long, made up of 13 segments and a key. Each segment weighs 1,050 lbs. and the total weight of the cast iron lining is 27,000 tons.

Parts of the Shield.—It will be noted from the discussion that the construction of the shield varies somewhat in accord-

ance with the character of the work under construction. The Brunel shield was rectangular in form to conform to the outline of his tunnel section. Modern subaqueous tunnels are usually circular in order to get the benefit of the full strength of the circular form of section. This explains to some degree why the circular form is better adapted also to the shield.

The system of tunnels under the North and East rivers, by which the Pennsylvania Railroad gains access to New York City and Long Island, is the greatest piece of subaqueous tunnel construction ever attempted. The length of the work and different conditions naturally to be expected required careful consideration in the design of the tunnel shields, air chambers, etc. The contractors for the North river tunnels were the O'Rourke Engineering Constructing Co., and for the East river tunnels, S. Pearson & Sons, Inc. The latter contractors had built the Blackwall tunnel in London by the use of a shield patterned after the design of Sir Benjamin Baker's. The chief engineer on the North river tunnels was Charles M. Jacobs, who had been chief engineer of the old Hudson river tunnel and also of the other tunnels projected and built under the Hudson river. The forms of the shields used in the North river tunnels, therefore, varied somewhat from those used by Pearson in the East river tunnels. The essential features, however, were, of course, the same. Figs. 11 and 12 show the front and back of the shield used on the North river tunnels. The exterior diameter of the shield was 23 ft. 6¼ in.; its length, 15 ft. 2⅜ in. The skin of the shield was made up of three steel plates ¾-in., ⅝-in. and ¾-in., respectively, making a total thickness of 2⅛ in., thus leaving an inch space all around between the tail of the shield and the tunnel lining. The tail of the shield overlapped the lining a maximum of 6 ft. 4½ in. during ordinary working and a minimum of 2 ft. during the operation of taking out any rams for repairs. This overlap also permitted the removal of any segment which might be fractured during the process of shoving the shield against it without exposing the dangerous ground.

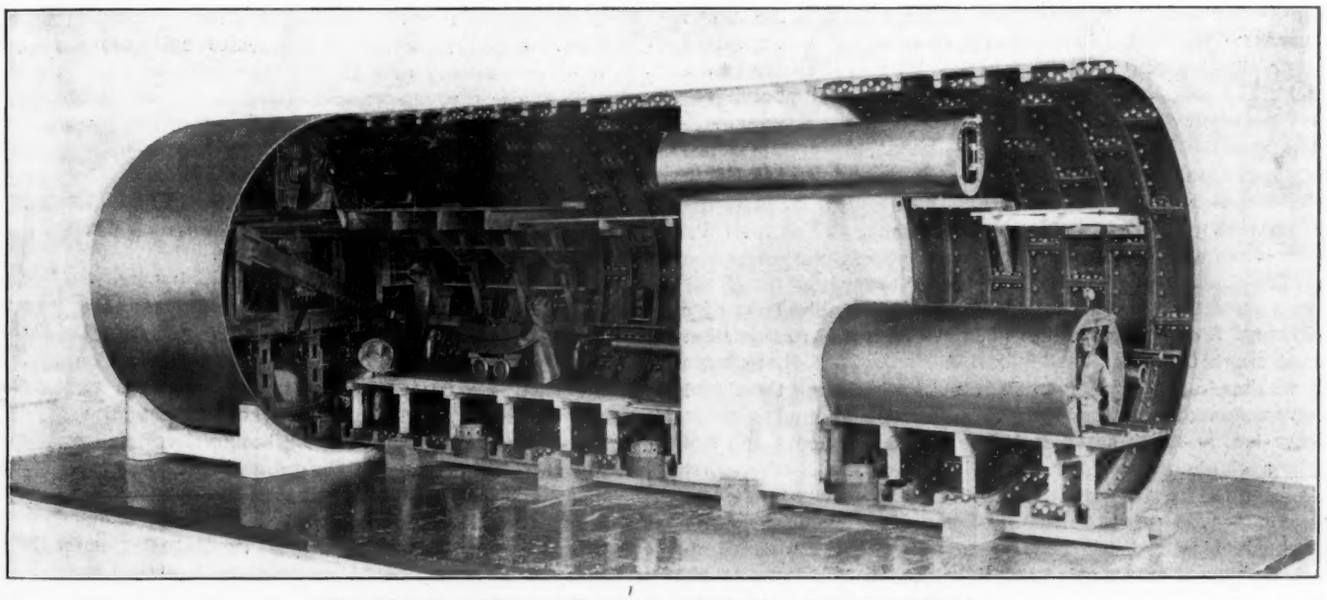

Fig. 12—Rear View of Pennsylvania Railroad Tunnel Shield.

The essential parts common to all large shields operating under compressed air are as follows:

1. *The Cutting Edge.*—Usually made of cast steel riveted to the shield skin and braced against the first diaphragm by structural steel brackets.

2. *The Working Platforms.*—Extending out under the cutting edge for use of workmen in excavating, forepoling, etc. These platforms are usually fixed. In the North river tunnel shield there were eight of these platforms which could be extended 2 ft. 9 in. in front of the shield by means of hydraulic rams, independent of the shoving rams, and when extended were strong enough to carry a load of 7,900 lbs. per sq. ft., this being equivalent to the maximum combined head of muck and water. These sliding platforms were conceived by James Forgie in 1894 and first adopted in 1895 under the direction of Mr. Greathead on the shield of the 23-ft. internal diameter tunnel of the Waterloo & City Railway, London. They were used in America in 1903 in the shield of the south tunnel of the Hudson & Manhattan.

3. *The Hydraulic Rams.*—The rams of the North river tunnel shield were 24 in number with a net diameter of 8½ in. and a stroke of 38 in., and were designed for a minimum pressure of 2,000 lbs. per sq. in., a maximum pressure of 5,000 lbs. and a test pressure of 6,000 lbs. The average working pressure was 3,500 lbs. per sq. in. The forward pressure of one ram under a maximum pressure of 5,000 lbs. per sq. in. was 275,000 lbs.; total pressure 3,300 tons. The rams were made subject to individual control so that differential pressure might be applied around the shield under the varied conditions encountered, the worst situation probably being the case of a tunnel half in rock and half in soft material. In the East river tunnel shields there were 27 rams, 9 in. diameter, 3 ft. stroke, tested to 9,000 lbs. per sq. in.

4. *The Diaphragms and Bulkheads.*—The North river shield had only one transverse bulkhead; no air locks or other provisions for maintaining higher face pressure and no material chutes or any discharges other than the nine openings fitted with doors. The East river shields were divided into nine pockets by two vertical diaphragms and two horizontal floors, and in addition to the two vertical diaphragms there were two transverse bulkheads completely closing the shield except for openings made for doors and muck shoots. The object of these two bulkheads was to maintain differential air pressure. By closing the doors of the forward bulkhead air could be pumped into the shield at a higher pressure than the pressure in the tunnel. The two transverse bulkheads also gave the shield an added stiffness. Great difficulty with this feature would have occurred in material composed part of rock and part of quicksand and the small reservoir of air contained in the shield would have caused great variation of pressure in the event of blows and flooding would have been frequent. As the maximum pressure in the East river tunnels was only 37 lbs. per sq. in., this refinement of diaphragms and bulkheads proved unnecessary and some of the material was cut out in order to permit more speedy operations.

5. *The Tail.*—The Brunel shield had floors in front for the use of the miners and at the back for the use of the bricklayers, and the brick lining was placed as the shield advanced. It is apparent that there is always a possibility of the flowing of material and the dripping of water into the tunnel through the space between the end of the shield and the lining. The tail in the modern shield avoids this difficulty by at all times extending over two or three lining rings, which are erected within the tail itself. The space between the lining and the shield being only 1 in., very little chance of material entering therein is afforded, and this is to be looked upon as one of the elements of large importance in subaqueous tunnel construction and an evidence of the farsightedness of Sir Benjamin Baker.

6 *The Erector.*—The weight of one ring of tunnel lining in the North river tunnel was 23,737 lbs., or an average of more than a ton per segment. They were, therefore, erected, as is common in modern tunnel practice, by means of an erector mounted on the shield itself and consisting of a box shaped frame mounted on a central shaft, which revolved in bearings attached to the shield. Inside of this frame was a differential hydraulic plunger 4-in. and 3-in. diameter and 48-in. stroke. To the plunger head were attached two channels which slide inside the box frame and to the projecting ends of which was attached the grip. At the opposite end was a counterweight which balanced part of the weight of the tunnel segment. The erector in the North river tunnel was revolved by two single acting rams fixed horizontally to the back of the shield, and with the single erector six rings of tunnel lining have been put in in eight hours. The East river tunnel differed from the North river tunnel in having two erectors moving about an angle of 236 deg. each. The erector in the North river tunnel was operated under 1,000 lbs. per sq. in. pressure.

The total weight of the North river tunnel shield was fully 200 tons; of the East river tunnel shield 185 tons.

Rate of Progress—The rates of progress in subaqueous tunnel practice vary, of course, with conditions. The record for the United States seems to have been made in the construction of the south tunnel of the Hudson & Manhattan, where large use was made of the method of advancing by closing the shield doors and shoving ahead in the soft silt and mud without excavation, as much as 62 ft. being done in 24 hours and 348 ft. in a single week. The entire length of the south tunnel was 5,100 ft. It was excavated in 334 actual working days at an average rate of 15.3 lineal ft. per day. The four Long Island shields in the East river tunnels, Pennsylvania Railroad Company, excavated 4,195 lineal ft. in 120 days, at an average rate of 8.74 ft. per day for a shield.

The most serious difficulty encountered in the shield method of construction comes from falls of sand from the face and from blowing out of the cover. The most effectual method to prevent these blowouts is that discovered years ago by Brunel of dumping clay into the chasms caused by the inrush of material and water, though something can be done by heating soft material in advance of the shield to dry it out and make it more stable.

There are three methods of excavation usually employed in advance of the tunnel: the ordinary method in comparatively firm ground of forepoling ahead and of excavating from the platforms; the pushing aside of the material bodily by closing the doors in the tunnel shield and forcing ahead with hydraulic jacks; also that of sluicing the material through the shield mixed with the proper proportion of water. A fourth method was followed in the Rotherhithe tunnel under the Thames, which was opened to traffic on June 12, 1908. It was built in a little over four years, though the contract allowed 5½ years for its construction. The tunnel, 30 ft. in diameter, was driven by the use of two shields advanced from opposite ends of the tunnel. One of these was 5 ft. shorter than the other, as it had to work around a long curve of 800 ft. radius. The longer shield was built of cast steel segments 60 in number in three rings, the segment in each ring breaking joints with those in the next, and weighed 380 tons. The front portion of the shield was provided with 16 working compartments by three vertical and three horizontal partitions, and the tail of the shield, 7 ft. 3 in. long, was built up of three thicknesses of ¾-in. plates riveted together. The shield was advanced by 40 rams 9 in. in diameter with 3-ft. 6-in. stroke, fitted with small internal drawback rams. These rams exerted a pressure of 3 tons per sq. in., or about 6,000 tons in all, and the lining was erected by two hydraulic erectors consisting of the usual arrangement of rack, pinion and sliding arm.

From borings on both banks it was thought probable that a bed of clay extended across the river, and in order to obtain definite information a small pilot tunnel was driven across the river in advance of the main heading. This pilot tunnel was 12 ft. 6 in. in diameter, lined with cast iron, the top being 2 ft. below the top of the main tunnel. It was driven with a shield fitted with a rotary excavator of the pattern introduced by the contractors in the construction of several of the London tube railways and in general resemblance to a rotary snow plow. The cutters were of steel and when the cutter head revolved scored concentric curves in the material forming the face. The speaker has called attention several times to the resemblance between shaft sinking by approved modern European methods and subaqueous tunnel driving, and would respectfully suggest that this method of a rotary cutter might be further extended and that a large size subaqueous tunnel might be constructed with the boring machines used in sinking deep shafts through water bearing strata.

(To be continued.)

WHICH LINE MAKES THE RATE?

BY WILLIAM Z. RIPLEY,
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In the case of competition between a direct and a longer, more roundabout line, which one "controls" or fixes the rate? It is an important matter, involving as it does the economic, if not the legal, right of a carrier to participate in any given traffic. Concerning this question the greatest diversity of opinion prevails. On the one hand, both writers[1] and practical railway men[2] aver that the short line makes the rate, while the long line merely meets the rate thus made. This is probably the more prevalent opinion. Yet expert evidence of an opposite sort is to be had for the seeking. The Interstate Commerce Commission has repeatedly held that the short line is at the mercy of the longer line under certain circumstances;[3] and traffic managers not infrequently plead their inability to control rate situations in the face of irrepressible, roundabout competition.[4] There is evidently a confusion of thinking, or else a loose use of terms where statements are so conflicting. As a matter of voluntary agreement among roads, or of prescribed rates under government regulation, the issue often assumes the form of controversy as to whether a road operating under a physical disability shall be permitted to participate in a given business by a concession in rates or not. Thus in the notable Milk Rate cases it was a question whether roads with heavy grades should be allowed to make concessions in rates. This issue really also underlies the question of enforcement of the Long and Short Haul clause. In the recent Spokane case the Harriman lines to St. Paul asked that they, being long lines, should not be compelled to reduce their rates to the figure prescribed for the direct Hill roads.

[1] Acworth, "Elements of Railway Economics," p. 125.
[2] Testimony of J. J. Hill, Elkins Committee, 1905, p. 1507; certainly in the Missouri-Mississippi river territory, the Hannibal-St. Joe distance rules.
[3] Especially in the Danville and St. Cloud cases; Int. Com. Repts., VIII, 357 and 429. Cf. the Vermont Central case, *Ibid.*, I, 182; and also I, 82 and VII, 481.
[4] An especially notable instance was the Canadian Pacific differential arbitration in 1898. Proceedings, etc., p. 73, argument of J. C. Stubbs.

It is clear in the first place that "short line" and "long line" are merely used as convenient terms to designate differences in the cost of operation. This was well put by James J. Hill before the Elkins Committee of 1905.*

The problem should really be stated thus in terms of cost, not of distance. Suppose the roundabout line to be in part or wholly by water, as in competition between the transcontinental roads and the Isthmian or Cape Horn routes, or as between the direct all-rail line from Boston to Nashville, Tenn., and the steamer line from Boston to Savannah, and thence up to Nashville by rail. In such cases the rail lines allow the water routes a differential or constructive mileage in recognition of their relatively cheaper per mile expenses of operation. The differential may sometimes exist, where, judging by the bulk of traffic, the advantage, irrespective of the differential, lies with the line giving the lower rate. In other words, as measured by volume of business, the stronger line and not the weaker one enjoys the benefit of the differential. This is the case in the coastwise traffic between Atlantic and Gulf ports; where the bulk of the tonnage goes by steamer and at lower rates than by all-rail lines. The difficult point to settle in all such cases is whether the allowance is made as a voluntary *concession* to the roundabout line because it *costs* more to operate; or whether it is a toll or tribute, because, irrespective of the cost, the long line rate is made on the basis of value of service. The problem, then, resolves itself into this: how far in practice does cost of operation really "control" the rate in cases of competition between two lines differently circumstanced in this regard? If cost is of fundamental importance, the "short line," using the term as above said in a figurative sense, "controls" the rate. If cost is an entirely secondary matter, rates being made in accordance with considerations of value of service, the "long line" holds the upper hand, and the short one is at its mercy.

It is important, moreover, in the comparison of costs of operation, to keep in view the inter-relation between fixed charges and operating expenses. This point is often neglected. Any well-considered outlay upon permanent improvements, of course, increases fixed charges according to the extent of the new capital investment; but at the same time it presumably lessens the direct cost of operation. The interest upon funds spent for heavier rails, reduction of grades, straightening of curves, better terminals or heavier rolling stock, must be set over against the direct economies resulting from heavier train loads, lessened expenditure for wear and tear, for accidents and claims or for wages. This relation between current expense and capital cost was clearly emphasized in an arbitration decision by the late S. R. Blanchard. Two roads were in competition for business at New Orleans. One had costly but convenient terminal facilities. The other was so far from the heart of the city that the drayage expenses were an important item. This second railway began by offering free cartage to shippers in order to even up with its more favored competitor; but this soon gave way to the practice of private teaming by shippers with an allowance on the freight bill for "drayage equalization." The other road objected to this on the ground that it constituted a virtual rebate; that in other words the weaker line was taking business at an abnormally low rate. The arbitrator, however, upheld the practice, on the ground that the heavier operating expense for cartage was merely an alternative for increased interest charges, had the road elected to construct costly and more convenient terminals. One road virtually paid money for team hire, the other paid it in interest on bonds.

Analyzing the main question two propositions are certain. Firstly, the long line can never charge *more* than the short line; whence it follows that as the short line reduces its rate, the long one must accept that rate as made; and, secondly, the long line, costing more to operate, is, in the process of reduction of rates, bound to be the first to strike the bedrock of cost incident to that particular service. To go below this point of particular cost would obviously be indefensible from every point of view. *The general rule, then, is that the "short line rules the rate."* This is accepted widely in practice, as for example throughout trunk line territory and between the so-called Missouri-Mississippi river points, where the short line from Hannibal to St. Joseph determines all rates by longer routes.† But the problem yet remains unsolved. The long line may never be able to charge *more* than the short line—may it, however, charge *less* under certain conditions? The moment it is enabled to do so, the long line and not the short line, for the moment, "controls the rate." If, now, we use the technically proper terms, the question becomes this: Under what circumstances is average cost of service in railway competition set aside in favor of other considerations; or, otherwise stated, when may a line, operated under a disability as to cost, properly give a lower rate than its competitors notwithstanding? Does disability justify a handicap or the reverse? This was the form which the question assumed in the notable Milk Rate case; as to whether the weaker lines in respect of distance or grades should be allowed compensation therefor by permission to charge higher rates.

One of the common instances of rate control by a line operating under a disability as to distance or normal cost is the competition of a bankrupt with a solvent property. The "roundabout" line, like the Erie or the old New York and New England, having repudiated its fixed charges, undoubtedly "makes" the rate which the other roads must meet or lose the traffic. Usually they prefer to absorb or control it otherwise financially, thus substituting monopoly for a ruinous condition of competition. Yet such instances resolve themselves, evidently, into questions of relative cost of operation after all. The bankrupt road holds the whip hand, because, having repudiated its fixed charges, its average costs of operation are correspondingly reduced. The validity of operating cost as a basis of charges is surely not shaken by this exceptional case.

The relative proportions and the distribution of local and through traffic upon two lines of differing length in competition with one another are primary factors in determining the ability of either one to "make the rate." This is, of course, especially true under the operation of any "long and short haul law," under which any reduction of the competitive rates would necessitate a lowering of the charges at intermediate points. No road is going to sacrifice lucrative rates upon a large volume of local traffic unless it can gain either a large volume of business or a very long haul from a competitive point. Many of the notorious rate disturbers in our industrial history have been "short cut" roads—the shortest lines between given important points, regardless of the nature of the intervening territory—like the old New York and New England, the Erie or the Canada Southern. Other roads, like the Chicago Great Western or the Central Vermont were more roundabout, and yet enjoyed but little local business, depending almost exclusively for their livelihood upon long hauls between termini. On the Central Vermont at one time, through business constituted 79 per cent. of the total; and only 5 per cent. was strictly local in origin. On the other hand, the Louisville & Nashville, in its original petition for exemption from the long and short haul clause, stated that 80 per cent. of its income was derived from local business. This consideration, as applied to competition between the two primary trunk lines, may not be without significance. As compared with the Pennsylvania Railroad, rich in local business, the New York Central, running along the narrow Mohawk

*"We will say that the distance from Cincinnati to New York is 800 miles, and that they haul 800 tons behind one locomotive on 1 per cent. ruling grades. Now somebody else builds a road with a 0.3 grade, and he can haul 2,000 tons—twice and a half the amount; but that line is 200 miles longer. You can see readily that to move a given number of tons the second road runs less than half the train miles, so that the farthest way round is the nearest way home in that case."

†It is also the rule in France. Elkins Committee, V, p. 273.

and Hudson valleys, has not inaptly been described as operating "between good points, but not through a good country." Under a strict enforcement of the long and short haul clause, the dilemma on the former road would be more serious than on the latter. To choose between its rich local traffic in iron and steel or coal and the long haul business from the West would be a more difficult matter for the Pennsylvania than for the New York Central management to weigh its through grain business against the local traffic from interior New York points.

In one way the persistence of locally high rates in the South and West, irrespective of the low charges at competitive points, is defensible on this ground:* Local business is scanty. The roads cannot live upon it. Their mainstay is the long-distance traffic from important points. On the other hand, where there is no obligation to maintain a distance tariff, of course the road with rich local business enjoys a great advantage in making rates at competitive points. It can practically subsist upon its revenue from its own particular constituency, meeting all its fixed charges thereby; and can afford to cut rates on the competitive tonnage down to the bone. Such a road, quite irrespective of the length of its line, would obviously "control" the rate at competitive points, as against any rival without such a subsidiary and independent source of income.

Volume of traffic is another fundamental element in the determination of cost of operation. No matter how short the line or how easy its curves and grades, unless it can handle its tonnage in large bulk it will operate at a disadvantage. Hence a most important factor to be reckoned with in deciding which of two competing lines is in a commanding position as to rates is the volume of traffic, both in gross and as susceptible of concentration on either line. In the notable Chattanooga case, for example, although the line from New York to Nashville, passing around to the South by way of Chattanooga, is 212 miles shorter than the lines via Cincinnati or Louisville, the latter, by reason of the density of traffic in trunk line territory, seem to stand at least on an even footing. On the other hand, the enjoyment of the bulk of the tonnage sometimes places its possessor at the mercy of a petty rival. The Fall River water line to New York, carrying an overwhelming preponderance of the business, obviously could not afford to cut rates to prevent the Joy Line from stealing a small portion of the traffic. The same principal holds good in other lines of business. The Standard Oil Co. can better afford permanently to concede a small fraction of business to a small independent dealer, so long as he knows his place and refrains from ambition to enlarge, rather than to attempt to drive him out entirely by cutting prices on a huge volume of business. Occasionally independents are shrewd enough to take advantage of this; and to so distribute their business that they shall in no single place menace a powerful rival, and yet comfortably subsist on the gleanings over a wide area.† In no single locality are they important enough to exterminate at the cost of cut rates applied to a large volume of business; and yet in the aggregate they may make quite a fair livelihood. The only difference between the status of a railway and other lines of business in this regard is that the railway may not be quite so free to deploy its forces. Its territory and tonnage are more definitely circumscribed by physical conditions of location.

A point to be noted in this same connection is the relative stability of the traffic. Is it concentrated in a few hands or does it arise from many scattered sources? In the former case either road by making a bold stroke may so entirely capture the business that, by reason of the enhanced volume, a handicap in operation may be overcome. Thus, in the notable instance of trunk line competition for the beef traffic, some twenty years ago, the Grand Trunk, although much more roundabout, besides being handicapped in other ways, by securing *all* the business could afford to make rates impossible under other circumstances.

Whether the business in question is natural or normal to a road, or is an extra, diverted from other more direct lines, is still another factor of importance affecting ability to compete successfully for any given traffic. The best statement of this is found in the argument of J. C. Stubbs before the Arbitration Board on Canadian Pacific Differentials in 1898.§ "These are differentials in favor of weaker lines—lines which upon the merits of their service cannot successfully compete for the business, but claim a share of it as the reward of virtue, the price of maintaining reasonable rates. . . . . For example, the Canadian Pacific road was not projected or built for the purpose of developing, fostering or sharing the carrying trade between San Francisco and the eastern part of the United States. . . . . After they were built and the various connections made, then, and not until then, it was seen that there was a business opened. The route having been opened, the newer and longer lines entered the field of competition against the older, shorter and more direct lines by cutting the latter's rates. . . . . In a fight of this kind, paradoxical as it may seem, the stronger line always got the worst of it. . . . . The weaker or longer line, not having any business at the outset, had nothing to lose. Everything was gain to it, which appeared to show an earning above the actual cost of handling the particular lot of freight. Quite a distinction between that and the average cost of handling all business. Such an inequal warfare could not long continue, and the common result was that the stronger line sought for terms, and ultimately bought the weaker line off, ... this class of differentials is and always has been obnoxious.

Our final conclusion must therefore be that the outcome in cases of inequal competition in respect of cost of operation can seldom be predicted with certainty. Everything depends upon local circumstances and conditions. Sometimes the long line and sometimes the short line will dominate. Careful analysis of every feature of the business must be made before positive affirmation is possible. This result is at all events worth noting. A due appreciation of the complexity of the business of rate making may safeguard us against the cocksure statements of the novice, who has never closely examined into the subject. President Taft has recently emphasized the need of expert service in the field of customs and tariff legislation. It is greatly to be hoped that a similar appreciation of the care with which railway legislation should proceed may prevail at Washington during the present session of Congress.

DOUBLE TRACK IN NEW HAMPSHIRE.

The map of the state of New Hampshire, published on the opposite page, has been made to show the location of all those pieces of railway in the state which have more than one main track. All railways in the state not here shown in heavy lines are single-track. The terminal of the double-track sections are as follows:

Boston & Maine.	
State line, N.H.-Portsmouth, N.H.	Tyngsboro, Mass.-Concord, N. H.
Atkinson, N.H.-Salmon Falls, N.H.	Through Nashua Yard, Keene Br.
	Claremont Jct., N.H.-Putney, Vt.

It will be seen that one of these lines is partly in the state of Vermont. No map of Vermont is to be published, the only other piece of double-track that we can find in the state being one a few miles long in the extreme southwestern part of the state, which will be shown in connection with the map of Massachusetts.

*Cf. Mr. Fink's testimony in Hearings Senate Committee on Interstate Commerce, 51st Cong., 1st session, Sen. Rept. 847, p. 29.

†For an instance in the tobacco business: Cf. The *Atlantic Monthly*. 1908, p. 487.

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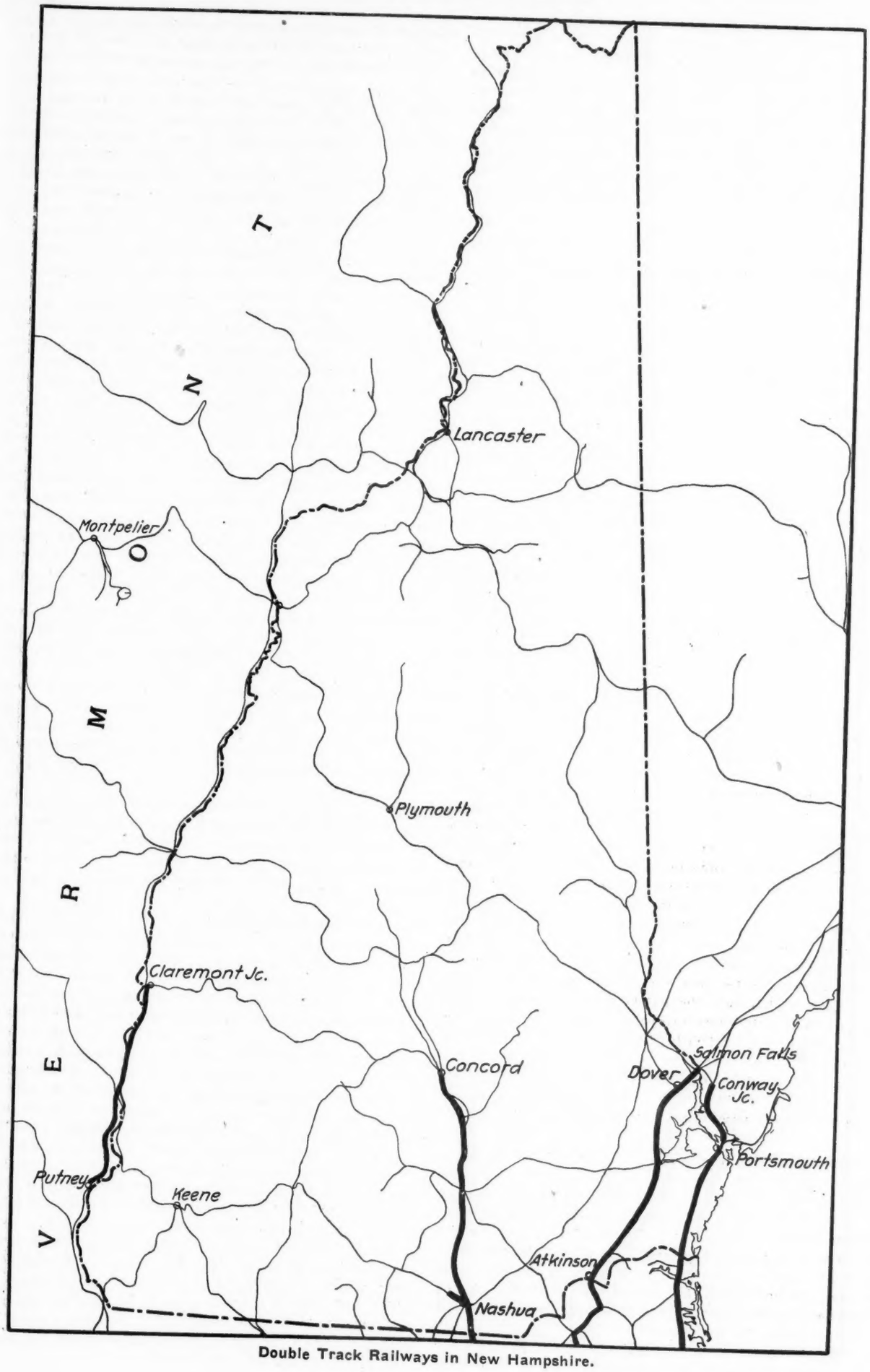


Double Track Railways in New Hampshire.

DOUBLE TRACK IN MAINE; CORRECTION.

In the map of the state of Maine, published March 25, page 823, the double track on the Bangor & Aroostook should be shown as extending from South La Grange directly southward to Northern Maine Junction, as stated in the text accompanying the map, and not southeastward, as shown in the map. Northern Maine Junction is six miles west of Bangor, on the Maine Central. South of Portland the name "Kennebunk" should be at the end of the double track, not midway.

THE TRAINMASTER'S FUNCTIONS.

II.

INSTRUCTION AND DISCIPLINE.

The attainment of a high degree of discipline, although difficult, is practicable if the trainmaster receives proper support from his superiors. To obey, men must understand clearly what is required of them. It therefore follows that close supervision to compel unfailing obedience, and intelligent instruction to enable the men to give this obedience, are alike indispensable. The necessity for supervision is generally recognized and employed, but the use of instruction varies with the intelligence and education of the instructor.

Every irregularity, however small, should be handled, as the mere handling constitutes discipline and is an unconscious, but effective, warning of ever-present supervision. It does not follow, however, that punishment should follow every irregularity, even if the responsibility is clearly proved as the greatest distinction should be drawn between wilful offenses and all other offenses. Wilful offenses should be met with merciless punishment, whereas the handling of others should be governed by the individuality of the man and his previous record. Two recent cases investigated at the same time fairly well illustrate the distinction just drawn. One man, acting as flagman, with nothing against his previous record, who was found asleep by the conductor when the train pulled into a siding, was instantly dismissed, in spite of earnest pleading of overwhelming drowsiness caused by fever which he claimed to have had before leaving the terminal. He had had, however, full rest before being called and could easily have obtained relief if he had asked for it. When he felt drowsy he should have notified the conductor, who could have taken steps to guard against that nightmare of responsible railway men, an open main line switch. For the sake of a very small sum he had placed thousands of dollars of property and human life in jeopardy. The other man, a baggagemaster, with nothing against his previous record, frankly admitted that in some inexplicable manner he had put a piece of baggage off at the wrong station, which only the quickest kind of tracing had been able to locate in order to avoid a heavy claim, and he had no excuses to offer. Firm in the belief that the error was due to one of the freakish twists, to which the best minds are subject, and that punishment would only hurt the pride of an ambitious man, the incident was at once closed, with an admonition to use all possible care to guard against a recurrence.

Collective instruction is almost invariably satisfactory in its results, especially when there is time for general discussion, as it brings out the views of many different minds, and, by enabling the instructor to perceive where the subject is least understood, permits him to apply the remedy at once. In the same way oral examination, although there must be a limit to the number being examined, in proportion to the thoroughness desired in the examination, allows the examiner sufficient knowledge of the proficiency of the men, but still permits him to remedy any deficiency on the spot.

Men who are good teachers, with the knack of making their pupils quickly grasp their meaning, and what is even more important, hold it, are few; but an efficient trainmaster must instruction the opportunities that the men have had for ac- have it. Before making any attempt at individual or collective quiring information on the subject to be discussed should be taken into consideration, for the trainmaster frequently has taken part in the arguments leading up to the adoption of a particular method of execution, whereas the men have only had the short, terse instructions in their unrelieved directness. The next step should be to realize how little the instructor himself could retain, if he were hearing the subject discussed for the first time, and then estimate the relative ability of the men in retentiveness as compared with his own ability. Although there is considerable difference of opinion as to the relative merits of individual and collective instruction, and, although I have found that, sometimes one, sometimes the other, best serves the purpose, the recent instructions issued on a certain subject by nearly all railways, constituting a formidable mass of information to be quickly digested, made it plain that, on such occasions, large class meetings alone would enable the trainmasters to reach all the men. After careful perusal of the instructions it was very clear that, in the limited time at my disposal, it would be impossible to make the men remember all the details, so I decided to summarize the entire subject in such a way that, if possible, it would be understood sufficiently to enable the men to know where to turn in the printed instructions for all doubtful points, and, by emphasizing the salient features, I tried to ensure their being memorized. If I had not mapped out this plan beforehand, and had attempted, paragraph by paragraph, to explain everything in detail, I should never have finished within the allotted time, and the men would have forgotten everything I had told them. As it is now, I have a series of well-understood sections to work upon for a more elaborate whole.

The trainmaster who listens to the soothing call of personal popularity, and who weighs any action by the effect it may have on such personal popularity, is building his citadel, discipline, on shaky foundations. In conducting investigations and arriving at a conclusion it is as much to the interest of a railway company to have a trainmaster protect the interests of the men as it is to have its own interests protected. Thereupon follows that indefinable and subtle something called *esprit de corps.*

Lack of system militates more than anything else against a high standard of discipline, for if small details are not taken up, classified and definitely arranged for with a view to a specified method of handling, there can be no thorough instruction of the men who cannot therefore be expected to obey.

In administering discipline, never take hasty action or snap judgment; never place the superintendent in the embarrassing position of being unable to support you. Do not allow technical or catch questions to be brought up, but the practical, every-day duties of a man in the transportation department.

To the end that team work may be developed to the highest degree, work up a good-natured rivalry by means of comparisons; hold frequent staff or class meetings, where you will bring out by discussion the object of the different rules, as well as a clear and uniform interpretation and understanding of them; call on the men to point out any rule or rules in the code which, in their judgment, should be modified or eliminated. Failing in this they necessarily acknowledge the importance of the strict observance of same. This puts the matter right home to them. Review any accident that may have occurred since the last meeting, and point out where the observance of certain rules would have avoided it.

The trainmaster must sometimes arouse his men to have them achieve better results. Some men only need a suggestion; others an appeal to their honor and sense of justice, while with others a good scare is better than good advice. It is possible to be quite right, and at the same time quite disagreeable, and in the main we awaken in others the same attitude of mind that we hold toward them.

INSPECTION.

He should, if possible, cover his division each week on local freight, as this is his best inspection train, stopping at all stations; it gives him the opportunity to properly inspect them.

Make notes of the errors made and put them before all of your men in a circular form, omitting names and places. Show what the results would have been had each man concerned done his full duty.

Look out for delayed cars, especially at non-agency stations.

Make periodical check of terminal yards and go through the shop yards (if in your charge) to see that light repair cars get their turn.

Make an inspection of cabooses and lockers at least once every three months to check up monthly reports required from conductors.

The trainmaster's movements should be so uncertain that the men will not be surprised to find him at any station, day or night. This fact alone will keep them on the lookout to properly carry out the rules and obey instructions.

Like a good district attorney he should know the law and have some ability as a cross-examiner, because some men lie; some evade the truth to shield others, but will not lie outright. Some will neither deliberately lie nor evade the truth, but will not tell all they know because they do not realize the essential points or have poor descriptive powers.

Thoroughly familiarize yourself with your assigned territory, covering all of it, including main line, branches and terminals, at least once a week. When on the road, keep your office and the chief despatcher minutely advised as to your whereabouts, present and future, and if any change in plans, notify headquarters immediately. This is absolutely necessary, as oftentimes it is required that you be located for important business without delay.

It is necessary that bulletins and special instructions be issued, but they should be curtailed as much as possible and gotten up in the most simple and plain language, so that your employees may understand readily and without difference of opinion. Carefully examine your bulletin boards or books when passing over the line, to see that all bulletins are contained therein and that dead ones are removed. Whenever possible approve all bulletins and special instructions before allowing them to be sent out. Some highly important matters, such as placing derailing switches on main line or passing tracks, should not be depended upon for safety by simply posting up a mail bulletin on bulletin boards. A regular "31" train order should be put out and receipts taken from your train and enginemen until such a time as it is fully covered, when the "31" order can be taken down and signatures in your bulletin books depended upon.

ACCIDENTS.

Train and enginemen should be taught thoroughness in making reports. Too many are prone to make a short report of accidents or failures without giving the details. They have a mental photograph of the occurrence, and it seems to them that the trainmaster should understand just how a collision or derailment happened.

My first experience as a trainmaster was on a division with which I was not familiar. I was called out with the wrecker to where a train had parted and run together, piling up some empty cars. When we arrived I instructed the wrecking foreman to turn the cars over and clear the main track, and he replied: "We don't do that here." I insisted that it be done and reported to the superintendent that the track would be clear at a given time; and then after investigation made a detailed report of the accident and told the despatcher to handle trains to the nearest point on either side of the derailment, which he did. The first train was let over within fifteen minutes of the time that I had named in my report, and I was complimented by the superintendent on the "concise and accurate report" rendered and the method used in clearing a busy main line, and the result gave me confidence that has been of assistance to me ever since.

The trainmaster should be able from his own knowledge and experience, to form a reasonable opinion and conclusion as to how the accident happened. In serious accidents that seem to call for investigation, get the entire crew or crews interested together, and hold an investigation, having clerk write it up, giving each employee copy of his own statement. Insist that each member of crew interested make a statement; if he knows nothing about the matter, let him say so. He cannot then come back later, when a grievance committee may be handling the case, with any other story.

The manning of the wrecking crew, its proper equipment with portable telephones, telegraph, first aid, etc., and the ability to get it out with absolutely no loss of time, detouring traffic and caring for such as cannot be detoured, indicate the character of a trainmaster's organization. Halting uncertainty at a critical moment costs the confidence of management and employees alike. It is imperative that prompt and vigorous action be taken in emergencies, and upon the trainmaster usually falls the duty of taking the initiative.

(To be continued.)

RAILWAY EXTENSIONS IN TRINIDAD.

With the advent of a new and energetic governor in the person of Sir George Le Hunte, the railways of Trinidad are likely to receive a great impetus in construction. The proposed extensions, although only modest, and amounting in length to little over 39 miles, are nevertheless of great importance to the commercial and agricultural interests of the island.

The territory to be opened up is a rich cocoa and rubber-growing district. There are no engineering difficulties to be overcome, nor will the expenses be at all considerable.

At the present time there are 82.8 miles of Trinidad government railway open for traffic, which is the same as in 1907, the railway having been first opened in 1876.

The extensions are two in number, from Tabaquite to Poole, and from San Fernando to Siparia.

The original survey in 1898 for the first line passed along the watershed ridge dividing the Nariva and its tributaries, running east, from the Ortoire and its tributaries, running first south, then east. This ridge has since been occupied by a cart road, and is perhaps impossible, at any rate difficult, for a railway at one or two points. The watershed ridge throws off from it a network of spurs and ravines, making it necessary either to keep to the ridge, or to descend by means of the best valley; no middle line is feasible. With a view of connecting up the settlements, the line would turn southward from the present Tabaquite station, and pass by the Palmiste into the Poole Valley, which it was intended to follow on to the Poole Bridge, on the Mayaro Trace, 12 miles east of Princess Town. This terminus was considered too far to the west, and too distant from Mayaro, a diversion, therefore, 9 miles from Tabaquite, has been made turning the line to the eastward into the Guayanapo Valley, and so to the Princess Town-Mayaro Trace, near the lands of the Poole syndicate, 15 miles from Tabaquite. This line intersects the St. John's and Brothers Settlement roads, a mile west of the Mayaro-Tabaquite road, and so opens up the Brothers, Sisters, North and Torib Trace settlements. The length of this line will be approximately 15 miles.

The estimated cost of construction is as follows:

Land and compensation	$30,000
Clearing	4,687
Fencing	17,187
Earthworks and River Diversions	93,750
Bridges and culverts	234,375
Permanent way	200,000
Stations, yards, etc.	26,041
Level Crossings and accommodation works	7,812
Telegraphs	4,687
	$618,539

The line will be of a somewhat tortuous nature, very similar to the already-existing Caparo line, otherwise there are no serious engineering difficulties in its construction.

The existing line to San Fernando, opened for traffic in 1882, terminates on the San Fernando wharf. In connection with it, but with approaches impracticable for heavy traffic, the San Fernando Tramway, the property of the government, runs through the wharf and streets for 1 mile into the country, at which point it joins with the Cipero Tramway, under the management of a nominated board of control known as the Cipero Commissioners. With the Cipero line there are connections by means of several sidings or branches.

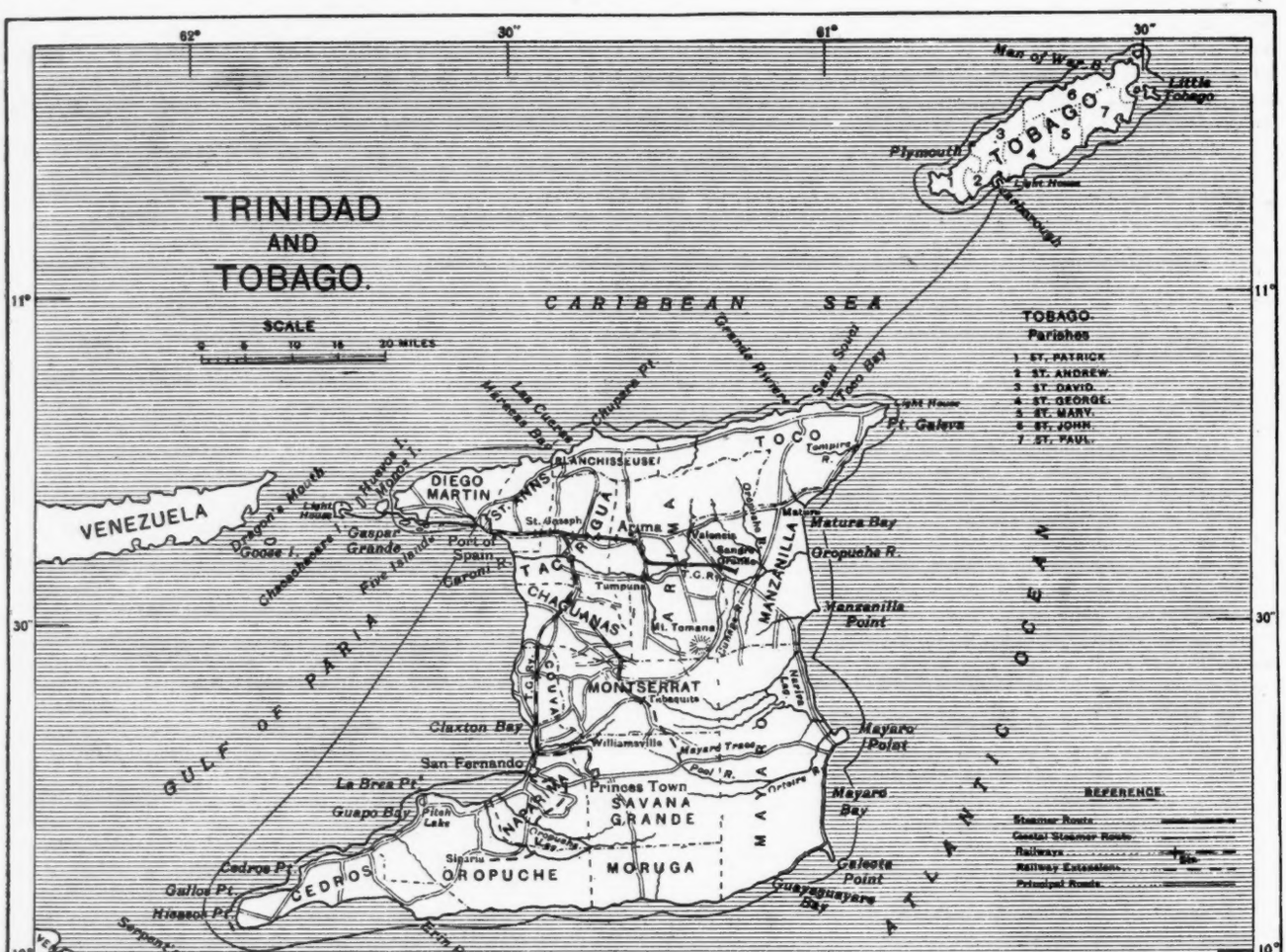
An offer of a free gift of lands required for this extension has been received, but the easier, although longer, line considered passes to the eastward of these properties, through lands of the Colonial Company, to a common point on the north side of the Oropuche Lagoon, at Dumfries, whence there is a line of high ground extending almost across the lagoon, forming a natural crossing, of which it is desired to take advantage.

The line selected passes across the wharf at San Fernando, and, by a diversion west of the hospital, rejoins the San Fernando Tramway near the southern end of "Broadway," following it and the Cipero Tramway to a point near the Corinth Line Junction, whence it turns south to join the Colonial Company's Fullerton branch, which is proposed to acquire and relay, thence to Dumfries, crossing the lagoon about half a mile west of Debé Settlement, gaining the Cura and Tururepano Valleys to the south of Siparia Village, about a quarter of a mile. The length of this line is a little more than 16 miles.

An alternative line would leave the Cipero Tramway near Victoria Village, pass through the Union Hall Estate, entailing a short tunnel through the Diamond Bridge, and thence to Dumfries. While this line would be a little shorter, it would entail more new, and heavier, work than the former.

There will be stations at St. Madeleine, Dumfries (for Debé, Picton and Wellington), Cura (for Rock-Penal, St. Francique) and Siparia. And the estimated cost of the line is $709,455.

The addition of 32 miles of new lines will entail the provision of additional rolling stock for them, which is estimated as follows: 4 locomotives with tenders; 1 composite coach, first and third-class; 1 second-class coach; 6 third-class coaches; 80 gondola cars; 40 box cars; 4 cattle cars; 2 horse cars; 2 cabouses; 2 engine turn-tables, at a total sum



Railways of Trinidad.

at $192,100. Railways were inaugurated there in 1874-76, with a line of 16 miles in length to Arima. Several extensions since carried out, have brought that length up to 82 miles at the present time. With the contemplated extensions, the total of the colony's system will be then brought up to 121 miles and still further extensions will be necessary in a few years' time.

On the Antung-Mukden railway the work of piercing the Fuhklinglin tunnel commenced in September is progressing satisfactorily. Latest reports are to the effect that up to December 15 a distance of 135 ft. had been pierced from one end and 80 ft. from the other. The contractors expect to have the tunnel completed by November, 1910.

Shop Section

Remember the competition which closes on April 15. A first prize of $50 and a second prize of $25 will be given for the best articles on "How the Foreman Can Promote Shop Efficiency." The manuscript must be from one thousand to three thousand words long and must be in our hands by April 15. Manuscripts worthy of publication, but not awarded a prize will be paid for at space rates.

Every successful foreman or shop manager has developed methods or made changes in the organization which have been productive of important results in increasing the efficiency of the shop or department. Don't let the fact that you may not have developed an elaborate or seemingly important scheme deter you from entering the competition. Sometimes very simple improvements or changes produce more far reaching and important results than others that are more elaborate and apparently more important.

A notable feature of the article descriptive of the foundry methods pursued by the Chicago, Milwaukee & St. Paul is the schedule of the hardness tests that were made on a section of a wheel. In this the expected is shown, though we have no record of such a showing having been made before. This is the indication of the variation in the hardness of the various portions of the wheel and the very marked lessening of the hardness as the distance from the throat is increased. It has long been suspected that there may be great variations in the hardness and quality of the treads of different wheels made from the same heat, owing to the variations in the temperature of pouring and other things that enter into the making of the wheel. It has also been urged that much of the running to sharp flanges that has been experienced may be explained by the difference in the wearing qualities of the wheels that are placed on the same axle. This test shows how well this may be the case. It also shows how very rapidly the hardness decreases from the surface of the tread down into the metal, and suggests the advisability of looking into many things along this line if the cast iron wheel is to hold, not its old monopolistic position, but any position in the future.

ENGINE SERVICE IN WINTER.

One of the best methods of measuring the efficiency of the locomotive repair shop, the thoroughness of the work done in the roundhouse and the skill and care with which the engineer handles his engine, is a record showing the miles run per engine failure. This record is found so useful for the purpose that it is now being kept by quite a number of roads. On some roads 5,000 miles per engine failure is regarded as a fair record, but good practice requires as high as 16,000 miles in freight service and 20,000 miles in passenger service. The difficulty in making any comparison of such records is that there are no uniform methods of reporting failures. Many roads report failures only for more than 5 minutes delay to passenger trains, or 20 minutes to a freight train, but others are able to keep their engines in such good working condition that they are able to apply a much more severe standard in defining the delay and consider two minutes delay to a passenger train and five minutes to a freight train as good cause for reporting a defect in the locomotive, if that is the cause of the delay. In order to make such reports useful for comparison it would seem worth while to take some measure to insure greater uniformity; it might be possible for the Master Mechanics' Association to secure such uniformity by appointing a committee to draw up rules for reporting engine failures, but as it is to some extent an operating question, it might be difficult to have such rules put in effect on all roads.

The past winter has been unusually severe for the operation of railways in the northern part of the country, where snows have been very frequent and deep and the temperature low. This has contributed to an unusual number of engine failures, and the records for summer and winter months should show the comparative efficiency of different roads in preventing the delays due to engine failures. The following table gives the average percentage of locomotives held out of service for repairs in February for six of the principal railways in the Middle West. It also gives the miles run per engine failure in December and January on these roads:

Locomotives out of service February, 1910.

Road.	A Per cent.	B Per cent.	C Per cent.	D Per cent.	E Per cent.	F Per cent.
Undergoing shop repairs	5.8	3.5	7.4	9.5	7.4	10.6
Awaiting shop repairs.	1.4	2.9	6.0	4.2	...	7,2
Under roundhouse repairs over 24 hours.	1.0	5.1	Not reported	1.1	9.7	7.2
Out of service, per cent of number owned	8.2	11.5	13.4	14.8	17.1	25.0
Out of service, total locomotives	126	172	241	216	235	275
Miles run per engine failure, *December*.	10,970	4,428	4,337	12,156	10,274	16,716
Miles run per engine failure, *January*.	10,232	4,456	Not out.	11,664	11,387	15,844

We are permitted to publish below the very creditable report of the Lake Shore & Michigan Southern, giving similar figures for their engine service during the past winter.

	Dec.	Jan.	Feb.
Average daily number of engines out of service	120	106	101
Miles run per engine failure, all services	16,299	20,212	21,138
Weekly average number of engines undergoing shop repairs	33	34	34
Weekly average number of engines undergoing engine-house repairs, over 24 hours	45	44	52
Number of engines waiting shop repairs on last day of month	18	14	..
Per cent. of engines out of service to number owned	13.4	11.8	11.4

WHAT WOULD YOU HAVE DONE?

The 1 o'clock shop whistle had sounded and the men were on their way back to work. An ambitious boiler shop apprentive, in a hurry to get started on his afternoon's task, had started to climb a ladder that was leaning against the boiler on which he was working. Another apprentice happened along and slyly kicked the bottom of the ladder, bringing it down with a crash. The result may be imagined. The two apprentices were good, live, healthy boys, not much worse nor not much better than their fellows.

A few blows were exchanged, when unfortunately the shop superintendent came in sight. A couple of the workmen tried to warn the boys, but were too late. The superintendent, a strict disciplinarian who had practically forgotten that he had ever been a boy himself, discharged the two young men on the spot. One of them, who assisted in the support of his family, was forced to take the best job he could find at the moment, and engaged in a class of work that he did not like and for which he was not particularly well fitted. The other boy could not find a job and loafed around for several months until the shop superintendent relented and took him back into service. During his idleness he formed habits and selected companions who have had anything but a good effect on him.

* * * * *

A shop superintendent had been engaged with a supplyman and was late in getting away to lunch. In order to save time he took a short cut through the car shop. Most of the men had finished lunch and were scattered about in groups, chatting or playing cards. Two of the apprentices were engaged

in watching one of the card games, one of them juggling two or three nuts in his hands. The game which they were watching was not particularly interesting, and like most apprentices who have nothing particular on their minds they were on the lookout for an opportunity for a little excitement.

An electric light bulb was hanging along the shop wall about 20 ft. distant. One of the boys suggested that the other one could not come within a mile of hitting it with one of the nuts. The second apprentice thoughtlessly took the dare, let the nut fly and the lamp broke into a thousand pieces with a loud report. The shop superintendent came along just in time to take in the situation. He called the boys over and in a few well directed words called attention to the seriousness of destroying company property, doing it in such a way that they felt very much ashamed of themselves. Then he commended the apprentice for throwing so accurately, and in spite of the fact that he was in a hurry for his lunch, gave the boys a little talk on the importance of selecting a proper goal toward which to work, and of using every energy to reach it. If their energies were thus rightly directed it would mean much for them in the future.

As he passed on the boys felt heartily ashamed for what they had done, and because of his good advice they started in on work of the afternoon with renewed energy. Keeping his words in mind both of them have successfully completed their apprenticeship and are doing splendidly.

THE SPEED LIMITS OF MALLET LOCOMOTIVES.

The speed limits of passenger locomotives were discussed in editorials in our issues of December 24, 1909, and January 28, 1910, which have been commented on in an interesting way by several correspondents, whose letters we have published. The speed limit of Mallet compounds is also an important matter which is now receiving considerable attention, as it has been found that it has a direct relation to their useful power when operated in service requiring higher speeds than those usual on mountain grades.

The area of the steam passages for both live and exhaust steam in the locomotive of ordinary construction has always been regarded as an important point in locomotive proportion, and it has been found especially important for passenger engines where the steam has high velocity. When the critical point is a local restriction of short length it is easily remedied, but if the restricted cross-sectional area of steam passages extends through long distances there is a drop in pressure due to friction of the live steam and an accumulation of back pressure in the exhaust which is difficult to overcome. An objection to the compound locomotive for passenger service is that not only is it not any more economical at running speeds than the simple engine, but the steam diagram is so attenuated that the same amount of power cannot be obtained from it as from an equivalent simple engine. This must be due in part to the friction and loss in pressure of steam following indirect passages. When a superheater is added and a longer travel is required, there must be a still further loss in pressure due to friction through the small superheater pipes. The use of a compound engine with a superheater of the small tube type would, therefore, not appear to be a good combination for a locomotive intended for express service.

In the Mallet compound the long shell is not all required for the regular smoke and gas tubes, as 20 feet appears to be the maximum practical length for these, and there is a long section of the shell available for a superheater, a feed water heater and a reheater for the steam passing from the high pressure to the low pressure cylinders. These have all been used in recent designs, and while they may be found advantageous in slow moving mountain helpers, or for road service handling maximum tonnage at slow speeds, it is not so certain that such a combination will be well suited for passenger locomotives unless the friction of the steam, both live and exhaust, is well taken account of and ample area is provided so as not to interfere with the desired pressure as usually found in simple engines.

In a recent design the live steam first passes through a superheater with baffle plates and tubes and around several elbows before reaching the high pressure cylinder. From this cylinder the high pressure exhaust makes four right angle turns before reaching the saddle connection to the boiler. From this point it passes through a 6-in. pipe with a generous right angle elbow to the reheater, where, after circulating over more baffle plates and tubes, it escapes to the receiver pipe, and after making four more turns it enters the low pressure cylinder. The exhaust from the low pressure cylinder is first carried forward in pipes outside the cylinders to a point over the forward engine truck wheels, then returns to a point back of the cylinders, and after passing four more right angle turns, it finally reaches the exhaust nozzle. While this exhaust pipe is of generous size, the tortuous route of the exhaust steam must produce extra back pressure on the low pressure pistons, and one would think its sluggish flow would not be effective in producing a good steaming boiler. The hot gases, after traversing the long boiler tubes, encounter additional frictional resistance in the superheater, the reheater and the feed water heater before they finally reach the smokebox, and a very efficient draft appliance will be required to overcome this resistance without producing undue back pressure.

While the Mallet locomotive admits of the use of the various appliances above named for producing economy of fuel in freight service, it has not yet been proved that the steam and hot gases can be successfully passed around numerous obstructions and elbows, at the high velocity required for passenger service, without producing objectionable results, and it would appear that considerable experimentation and some modification of the accepted designs will be necessary before such a type of locomotive can be operated successfully in passenger service.

We understand that Mallet freight locomotives in road service reach their maximum power below 20 miles per hour and at about 17 miles per hour the power is so restricted by friction of steam through numerous passages, as above described, that the useful tonnage hardly exceeds that of a good sized simple consolidation engine.

THE APPRENTICE.

The successful apprentice instructor, or the foreman who has the faculty of developing the apprentices under him and bringing out the best in them, is the one who can look back over his own experience and realize the state of mind and the feelings which he had when he was in a similar position. The first six months or the first year of apprenticeship is a critical period. During this time especially the apprentice must be watched closely; his character and disposition must be studied, and he must be treated as an individual. Too often a boy's whole future is spoiled by indifference or carelessness on the part of those who have charge of him during this period. Mr. Creary, in speaking before the meeting of the apprentice shop instructors of the Santa Fe on "The Boy's Side of Apprenticeship," seems to have the rare faculty of appreciating the apprentices' feelings, as will be noted by his discussion, which will be found in this number. For those who are interested in apprentices, this article has a peculiar value.

It is not always an easy matter for the shop foreman to look at the problem from Mr. Creary's standpoint, but it is absolutely necessary to do so if he is to be successful in handling the young men under him. Even if he does have the rare faculty of understanding the boys, he will find it greatly to his advantage to study those principles of ped-

agogy and psychology that are being used to such splendid advantage in our modern systems of education. This sounds rather formidable, but it does not mean that it is necessary to know or understand all about, or even very much about, these subjects. Several writers have emphasized the more important principles which are involved in a most simple and readable manner. A good example is Margaret Slattery's "Talks to a Teacher's Training Class." While, as its title indicates, it is not primarily intended for railway shop apprentice instructors, yet the principles are just as true for the apprentice as for young people in general; the book has been a great inspiration and help to some of the instructors who have made use of it. In most interesting way Miss Slattery tells of the characteristics of young people of different ages, and as to how they may be developed and influenced to the best advantage.

An important feature of improved apprenticeship methods, such as are in use on the Santa Fe and the New York Central Lines, is that the boys who are not suited for the trade to which they are apprenticed are quickly discovered, and may be transferred to a department or a work for which they are better fitted.

Letters to the Editor.

SHOP KINKS.

March 12, 1910.

TO THE EDITOR OF THE RAILWAY AGE GAZETTE:

The shop kinks that you are publishing are of great value to railway shop foremen and mechanics; they give them, without any effort on their part, the results of the labor and efforts of others (in some cases of years) in experimenting and perfecting these tools and appliances.

There is no question but that the man who selects these kinks and prepares the article should be given proper credit for his labor and be reimbursed for it, as you are doing; but I believe that the inventor, the man who through his ingenuity, thought, labor and experiments, which in some cases were kept up for years before the device was simplified and made practical, should be given some of this credit. His name should be given in the article, also the position he occupied and where he was located when he developed the tool. Of course, in a good many cases this cannot be done, but where it is I think you will agree with me it should be done. There is a great difference in the labor entailed in measuring up a tool already made and making a drawing of it, from the thinking out of the original design, making the device, trying it out and changing and strengthening it until you have the completed and practical tool.

Then again, some of these machines are patented, but mention is not always made of the fact; this is neither fair to the patentee nor to the readers. The former may lose a lot of revenue he is entitled to, and may never see or hear of the invention having been used without his sanction. The reader may make one of the machines and later find that he has put his foot into it for using a patented tool.

I have seen write-ups in the daily papers in the neighborhood where some of these appliances were gotten up, calling attention to the mechanical and inventive ability of the men who have sent in the material to you, and calling the public's attention to these tools as having been devised by these parties, when, as a matter of fact, they had no more to do with them than Adam did.

Wherever it can be done, the inventor's name should accompany the sketch; this will encourage him to continue his efforts and make him feel that he is not using his brain and lying awake nights for someone else's aggrandizement.

Trusting that you can do this, even to publishing the names of the inventors of tools that you have already described, but which have not been properly recognized.

Yours in fair play,

A MECHANIC.

[The writer's points are well taken. The editors are anxious to give credit where it is due, and ask the co-operation of contributors and readers in seeing that this is done. Contributors who send in descriptions of patented devices are asked to make note of the fact.—EDITOR.]

Contributed Papers.

THE BOY'S SIDE OF APPRENTICESHIP.*

BY THOMAS CREARY,
Apprentice-Shop Instructor, Blacksmith Shop, Topeka, Kan.

The boy who, from force of circumstances or a dislike for study, abandons his school work must do one of two things. He must seek some kind of employment or become a loafer. Fortunately most boys prefer going to work and it is at this period of his life that the boy begins to look about for some employment that will not only be congenial, but will also bring him a fair remuneration for the service rendered. The thoughtful boy also has the future in mind and takes into consideration the possibilities of advancement in the work he is about to take up. Large industrial plants, such as the Santa Fe maintains at various places along its lines, naturally attract the boys and many make application for employment, a majority with the intention of learning a trade, and a few who are undecided. It is the boy who files an application for apprenticeship that I have in mind. In many instances he has a decided fancy for some particular trade, and again there are quite a few who do not know just what they would like to follow.

Were it in my power to direct the preliminary movements of the prospective apprentice I would have him report at the shops some morning. I would meet him and take him through the various departments. We would make the trip leisurely giving him ample time for observation and a chance to see what actual shop conditions are. A trip to the school would also be made and then he could see the progressive lessons in drawing, arithmetic, etc., giving him an idea of what systematic effort will do for a boy. I would have him tell me if any particular operation or process he had witnessed interested him, and what interested him most. In this way a boy would be enabled to better decide just what trade he prefers.

I firmly believe in a boy being allowed to follow his natural inclination in regard to mechanics. Boys are too often the victims of circumstances in being assigned to trades for which they have no adaptability. This is often the result of parental persuasion, the boy's fitness not being at all considered; and again boys are pushed into trades just because there happens to be an opening. This is wrong, wrong to the boy because he can never hope to attain the high degree of skill or proficiency he would if allowed to follow the trade of his own choosing, wrong to the company because of the low efficiency and perhaps utter failure which is bound to follow such an assignment.

After the trip through the shop and school and after the boy has decided what trade he prefers, then the real test of his judgment begins. He is ushered into the shop and begins his four years' term. He sees strange faces all about him, strange machinery, hears strange noises and for a time is bewildered. He gazes in wonder at what is going on about him and just at this particular time is apt to become so interested in what someone else is doing that he forgets for a moment what he is doing himself.

*Read before a meeting of the Apprentice-Shop Instructors of the Santa Fe System, Albuquerque, New Mexico.

After a time all this wears off and he becomes accustomed to his surroundings and settles down to business. By easy and progressive stages he is being led along the line of his chosen work and if his judgment has been good it will soon crop out in many ways. When he is told how to do a piece of work he readily grasps the idea. He develops the knack of taking advantage of his work in many ways, some perhaps a trifle crude, but it shows that he has his mind on his work and is using his brain as well as his hands. He is eager to advance; takes pride in the quality of his work; he makes slight mistakes and has his faults; both are trivial and, aside from a kindly suggestion in the right direction, should pass unnoticed. A boy continually nagged becomes discouraged and disgusted but he feels no resentment at being called down for a breach of discipline or an error caused by carelessness on his part. He takes pride in keeping up the quality of his work and feels that in estimating time on jobs that come to him, care should be taken so that a fair schedule may be made, as he takes pride in keeping up his efficiency as well as the quality of his work. He is not insensible to a compliment passed by his foreman or instructor regarding the general excellence of his work.

Some boys have not the faculty of seeing into things mechanical as readily as others. This should be noted and a special effort made to get the boy straightenend out. If after a fair trial the boy shows no adaptability he should be released and allowed to take up something better suited to his talents.

The boy who makes good during the probationary period should not be anchored to one job so long that it will become tiresome. He is eager to forge ahead and his progress should be limited only by his ability and development. A bright boy pushed ahead will serve as an example for the laggards and will stimulate an increased effort on their part to get close to the leader. As he progresses along his four-year course of shop practice, his hands becoming more skilled each day, it dawns upon him that by the skill of his hands alone his future advancement will be uncertain. With this thought uppermost in his mind he sets to work to develop his mental powers. Aside from an increased interest in his regular school work he provides himself with good books concerning his particular craft; he also subscribes for a magazine published in the interest of this branch of mechanics and in this way keeps in touch with all that is new and progressive in his line.

In the daily papers he frequently reads of some man being appointed to a higher position in the railway world. He notes with interest the story of the man's rise from the bottom of the ladder, all brought about by his own ability, hard work and close attention to business. He becomes more convinced each day that it is the man who does things who rises above the free and easy fellow whose greatest care is watching the clock or waiting for the whistle to blow. He realizes that it is not within the reach of all to rise, but he is determined to leave no stone unturned in the way of preparing himself for advancement along his line of effort. To the boy who has this ideal in mind, every opportunity and encouragement should be given so that his advancement will not be retarded to such an extent as to cause him to lose interest.

Occasionally bad luck will cast its discouraging shadow over his path; nothing goes right; everything goes wrong; on an occasion of this kind it is sympathy and not censure the boy requires. His youth will perhaps at times assert itself and find expression in various pranks; never with evil intent but always with a view of getting something humorous out of the situation. When in this mood, he is no respector of persons; his foreman or instructor may be his victim. We were all boys once and, judging from the little improvement some of us have made, we were worse than the boys we now have to contend with.

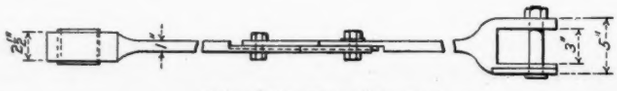
The capable boy who has finished his apprenticeship and shown his loyalty to the company by remaining with it, should, when opportunity offers, be given a promotion of some kind and a chance to make good. Before this young man there lies a field of golden opportunities and to a very great extent he is the architect of his own fortune. By attending strictly to business and taking full advantage of the benefits and privileges his apprenticeship has afforded, the boy's future cannot be other than bright. Let him do his share to bring about a realization of the management's dream in establishing this system, namely, the training of a sufficient number of bright, loyal young men to fill every position in the mechanical department, and he will rise according to his merits.

DISCUSSION BY B. D. MILEHAM,
Apprentice-Shop Instructor, Paint Shop, Topeka.

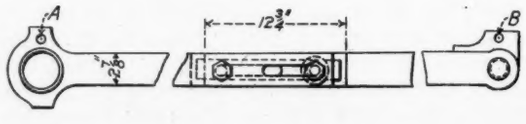
If I want the confidence of the boys under me I endeavor to teach them that they must first of all rely upon me as a business confident, that if they come to me for information upon any subject pertaining to the painting business they can get it in full detail, given with great pleasure and in its entirety. Don't let us make the mistake of trying to govern all boys by the same tactics. Be a student of human nature. Study their different dispositions. When you meet them talk and act to suit their particular and different dispositions. You must handle some with a curbed-bit; with others of a gentler nature, moral suasion is the better way. Don't be austere and hard to approach, but let them feel that their inquiries are solicited.

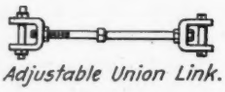
SETTING VALVES WITH WALSCHAERT GEAR.

The usual practice of setting valves on locomotives equipped with Walschaert gear, is to change the length of the eccentric rod three-quarters of the amount the valve is shown to be out of square. The rod is then removed and a cut and try method used, which takes considerable time and labor. This may be eliminated by using the device shown in the illustration. It consists of an adjustable ec-

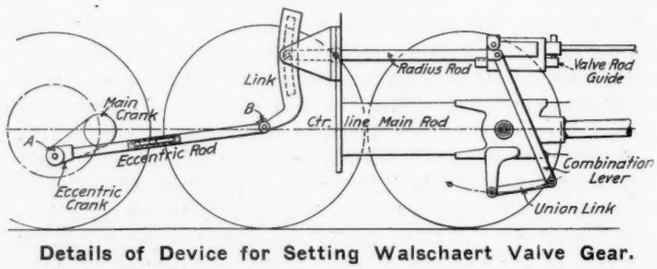


Adjustable Eccentric Rod.





Adjustable Union Link.



Details of Device for Setting Walschaert Valve Gear.

centric rod and an adjustable union link. The original eccentric rod and union link are removed and the adjustable devices are put in their places. These are adjusted to the proper lengths for the correct position of the valve. The centers A and B on the ends of the adjustable rod eliminate the necessity of having to find the centers each time. The proper lengths being obtained, the original rods are made to correspond. This device is used by H. F. Grewe, general foreman, Wabash-Pittsburg Terminal Railway, Rook, Pa.

Shop Kinks.

FROM THE ELIZABETHPORT SHOPS OF THE CENTRAL RAILROAD OF NEW JERSEY.

BY F. E. LISTER,
Associate Editor of the *Railway Age Gazette.*

The shop kinks given herewith were gathered at the shops of the Central Railroad of New Jersey at Elizabethport, N. J. In this connection we wish to acknowledge our indebtedness to C. E. Chambers, superintendent motive power, who made the necessary arrangements looking to this end.

The mechanical department organization of this road places the locomotive and the car departments under separate heads, each of which reports direct to the superintendent motive power. G. I. Van Doren, superintendent shops, is in charge of the locomotive work, while William Alter, general foreman car snops, is in charge of the car work.

The thought has been expressed that the supply of shop kinks would soon be exhausted, judging from the numbers which have appeared in these collections. There seems every reason to believe that the supply, rather than being exhausted, will increase, for a time at least. It is a noticeable fact that in gathering shop kinks, the main difficulty lies in locating them about the shop. Being in most cases made up from rough sketches, no record of them is made, and after being in use for some time, they are forgotten as shop kinks. Although used continually, they do not stand out and are found only after persistent search.

Car Shop.

The shop kink competitions and the several other collections which have appeared in tne *Railway Age Gazette* since the first competitive collection on October 1 last, have failed in one respect, that of bringing out a share of car shop kinks equal in number to those of the other shops. It is a generally accepted fact that the field for kinks is much more limited in wood-working than in iron-working and this fact has been borne out in the results of the past months.

The present collection shows, however, an advancement in car shop kinks, not so much in the number as in the real merit of the devices shown. The pneumatic jack, the diaphragm face-plate straightener and the spring testing machine show very well developed and useful devices and they should receive the deserved approval of all car shop men. C. O. Fuss, car shop foreman at Elizabethport, is the originator of these kinks and he is authority for the statement that they have resulted in a considerable saving of time and money in his department.

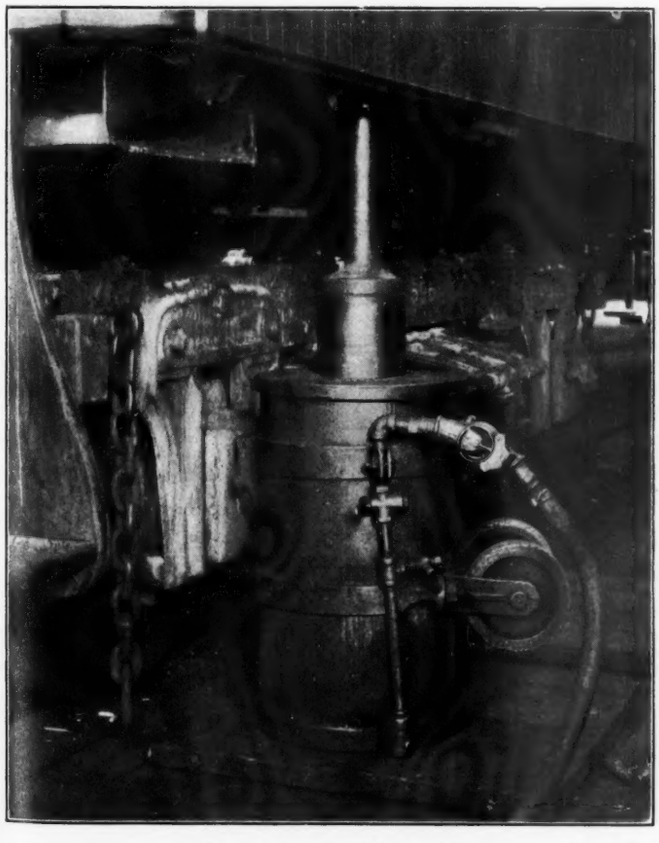


Fig. 1—Pneumatic Jack.

PNEUMATIC JACK.

In the accompanying half-tone, Fig. 1, and the line drawing, Fig. 2, are shown a general view and details of a pneumatic jack, which is an exceedingly efficient and necessary car shop

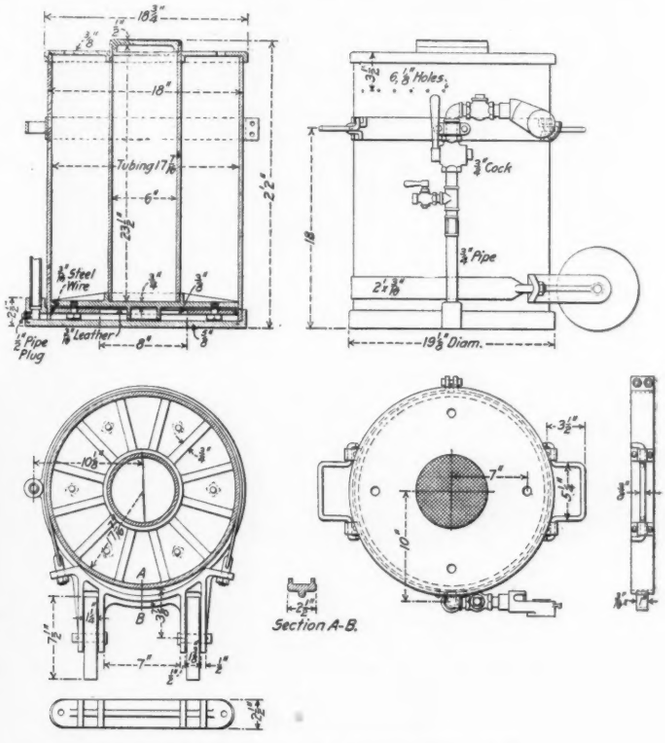


Fig. 2—Details of Pneumatic Jack.

kink. The half-tone shows this jack in place under the end of a coach. In jacking up a coach, it is of course, necessary to use two jacks under each end. Air hose connections are made to operate the jacks simultaneously, which provides for their moving equally, both as to speed and travel. One man operates the jacks through one valve, while the second man arranges the blocking and different height horses on which cars are placed after the trucks are removed.

The cylinder is made of a piece of tubing, 17 7/16 in. in diameter by 24 in. long. The top and bottom heads are made of cast iron, as are the piston head and cap, the follower plate and the wheels. The bracket which carries the wheels is made of cast steel. The plunger is made from a piece of 6-in. pipe, which screws into the piston. Air enters through a port cast in the bottom head. The drawing shows the original design of using a cap on the plunger, but this has been changed, as shown in the half-tone, to a longer ram, with the

use of which it is not necessary to block up to the sill, but run the ram against it direct.

DIAPHRAGM FACE-PLATE STRAIGHTENER.

The accompanying half-tone, Fig. 3, shows as used, a very effective device for straightening diaphragm face plates. The line drawing, Fig. 4, gives two elevations, which show the device to be simple, though requiring some skill in forging. The I-section shape of the feet provides for using the device for straightening any bend in a diaphragm face plate, the

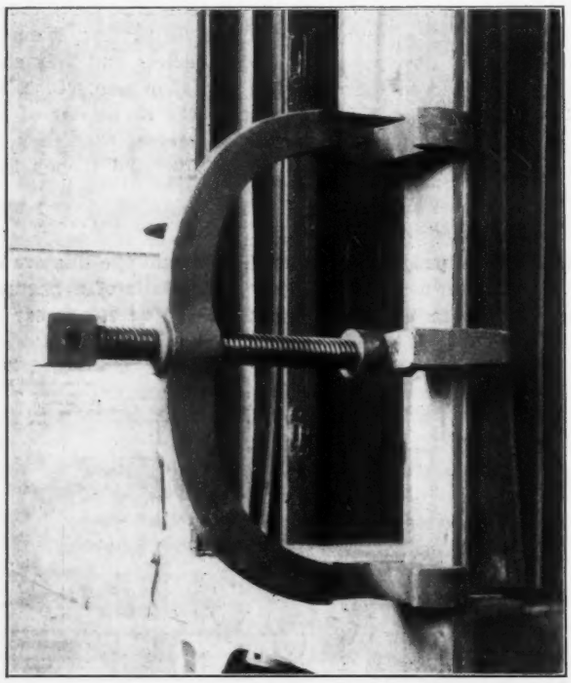


Fig. 3—Diaphragm Face Plate Straightener.

screw being run in or out as required. The screw is double square threaded, 1¾ in. in diameter.

In the majority of cases, the diaphragm is bent inward and the device is used as shown in the half-tone. It can be placed

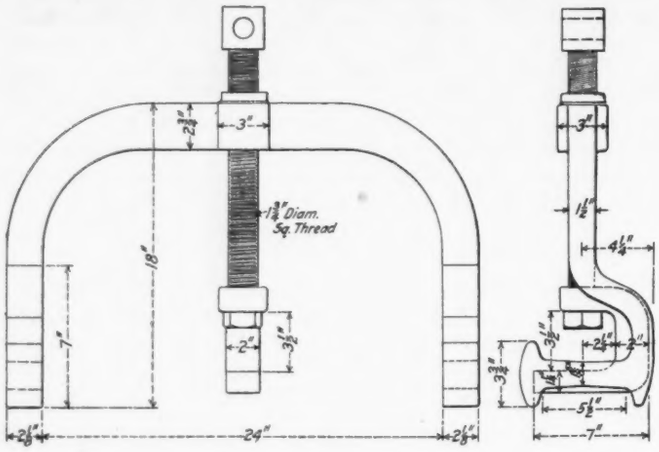


Fig. 4—Details of Diaphragm Face Plate Straightener.

in about four or five minutes and the face plate straightened in about the same time. Without this device it would be necessary to remove the face plate, which would mean taking off the diaphragm and in a good many instances, the tearing of it and the necessity of placing a new one. Although the center clamp bears against a portion of the diaphragm, it is not injured.

This device is also applicable to a variety of other uses, such as straightening truss rods in place, or the light channel-section shapes used in coach construction.

LIGHT COACH STEP HOIST.

In the half-tone, Fig. 5, is shown a light hoist used for holding steps in position while bolting them in place. The cylinder is made from a piece of brass pipe, 2¼ in. in diameter by 28 in. long. This pipe is tapped into a cast iron base,

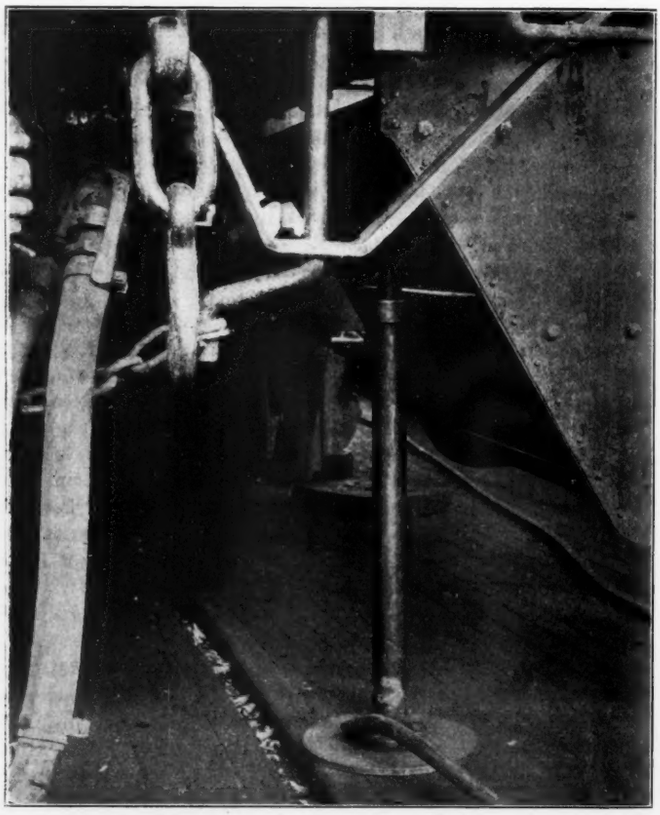


Fig. 5—Light Coach Step Hoist in Position.

through a port in which the air enters. A 12-in. diameter base is bolted to the cast iron one, and maintains the hoist in position.

Unless some device is used for this purpose, two men are required in putting up a pair of steps, one holding in position while the other places the bolts. With this hoist, one man can do all the work, as the hoist holds the steps in their position.

CLAMP FOR GENERAL WORK.

A clamp for general use about the coach shop, especially for drawing together coach framing, siding, etc., is shown in the line drawing, Fig. 6. It has a maximum range of 13 ft., which is ample for all uses to which it can be put. The U-shaped pieces, as well as the running rod, are made of ⅞-in.

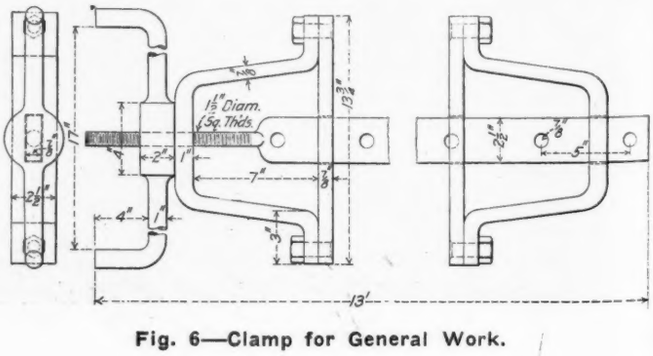


Fig. 6—Clamp for General Work.

x 2½-in. iron, making the clamp rigid. The running rod is drilled with ⅞-in. holes on 5-in. centers for its entire length, and as the square threaded screw has 9-in. length, ample provision is made for any condition. The tightening nut has two 8½-in. arms, giving sufficient leverage.

COACH SPRING TESTING MACHINE.

The coach spring testing machine used at Elizabethport and shown in the accompanying illustration, Fig. 7, is used on every coach spring placed in trucks. Freight car brake cylinders, arranged in tandem, connect to a common crosshead and exert an even pressure on the spring. The springs are handled to the machine by a pneumatic hoist, running on an overhead track, and by the hooks shown in the illustration. A table is posted on the side of the building near the machine, which shows the pressure to which the springs should be tested. After the spring is in position and the wooden block placed, as shown, the air is admitted to the cylinders. The spring is then given the pressure which it should withstand according to the table, when its height is measured. If the spring then shows the correct loaded height it is O. K., otherwise it is rejected.

The chain, weight and lever arrangement shown provides

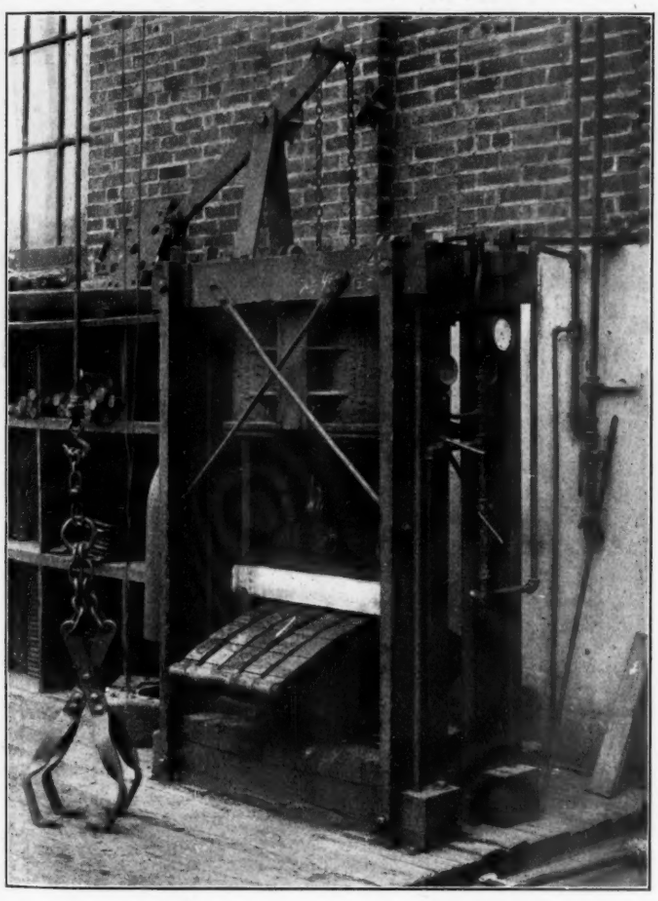


Fig. 7—Coach Spring Testing Machine.

for lifting the crosshead, pistons, etc., when the air is exhausted at the conclusion of a test. This machine is located just outside the coach shop and adjoining one of the tracks and the spring storage floor.

COACH SHOP SCAFFOLDING.

The scaffolding, a portion of which is shown in the half-tone illustration, Fig. 8, does not differ materially from that used in most shops, but it does show a design which is extremely simple and at the same time very effective for working on the sides of coaches. The brackets are made of ½-in. x 2-in. material, the horizontal and oblique members being made of one piece and bolted or riveted to the vertical member which carries the hook. The iron rounds are spaced 10 in. apart. The uprights are loosely bolted to the horizontal timbers and fastened to the floor by bolt latches. This latter provision allows for swinging the uprights in to the center post so as to be out of the way when not in use. The top cross member is rigidly bolted to the shop building posts, at about 10 ft. 6 in. from the floor. The runways are made heavy and trussed with ⅜-in. rods, the queen posts being made of 1-in.

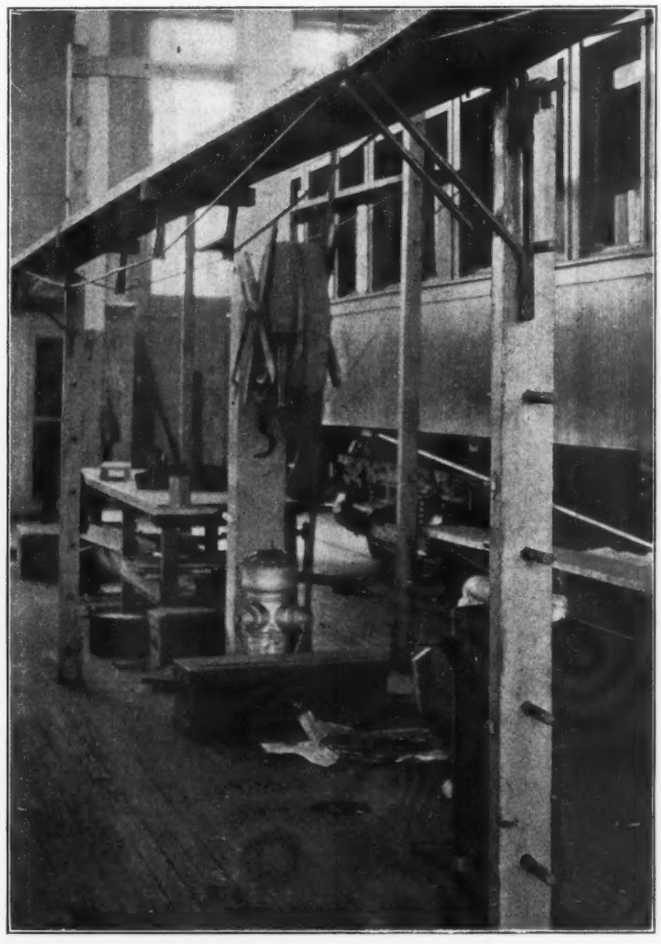


Fig. 8—Coach Shop Scaffolding.

pipe, flattened on the lower end. This illustration, besides showing the general construction of this scaffolding, also shows a plug and reel of hose for fire protection.

Air Brake Shop.

The Elizabethport air brake shop occupies a portion of the general storeroom building, being separated from the store section by a low board partition, which is extended further upward by wire screening. A new Westinghouse triple valve testing rack is placed on one side of the space, while a circular multiple angle-cock grinding machine is located in one corner. All triple valves are thoroughly tested before leaving the shop.

Quite a little ingenuity is displayed in the utilization of the space available for the work, the manner in which hose, valves, etc., are handled and stored and in the use of home-made efficiency devices. In Figs. 9 and 10 is shown the method of stripping and fitting up hose. J. V. Brannan, foreman air brake shop, is at the present time having made a new machine for stripping, one which will strip both the coupling and the nipple end simultaneously.

BRAKE HOSE STRIPPING MACHINE.

The half-tone illustration, Fig. 9, shows a machine in the air brake shop fitted for stripping the nipples and couplings

from brake hose. This same machine is used for fitting up new hose, in which case air is admitted at the rear rather than the front of the piston, giving a pushing instead of a pulling movement. The nipple or coupling is gripped by the double-jawed, hook-shaped clamp, so designed that its hold becomes more firm as the pressure acts. The hose is held between two eccentric and fluted dogs, and as the pulling action tends to draw these flutes into the hose, it is firmly gripped. Another view of this same machine is shown in Fig. 10, the top view showing this eccentric action very well.

When used as a fitting-up machine one of the detached castings seen in the illustration is substituted for the double-

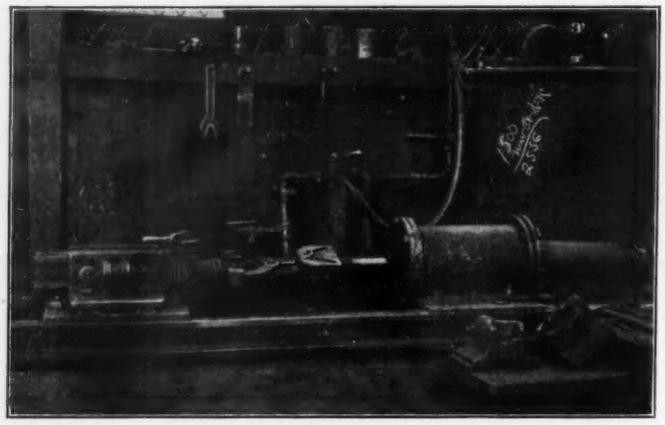


Fig. 9—Brake Hose Stripping Machine.

jawed hook shown screwed on the end of the piston rod. These castings are made to fit the irregular surface of the hose coupling, and such that it is held, during fitting, without being clamped, it being only necessary to place it in the casting. The air control valve is placed in a convenient position for the operator standing in front of the machine.

BRAKE HOSE REPAIR BENCH.

The brake hose repair bench, with the stripping and fitting machine shown in Fig. 9, is seen in the half-tone illustration, Fig. 10. The various devices used in this work and their ar-

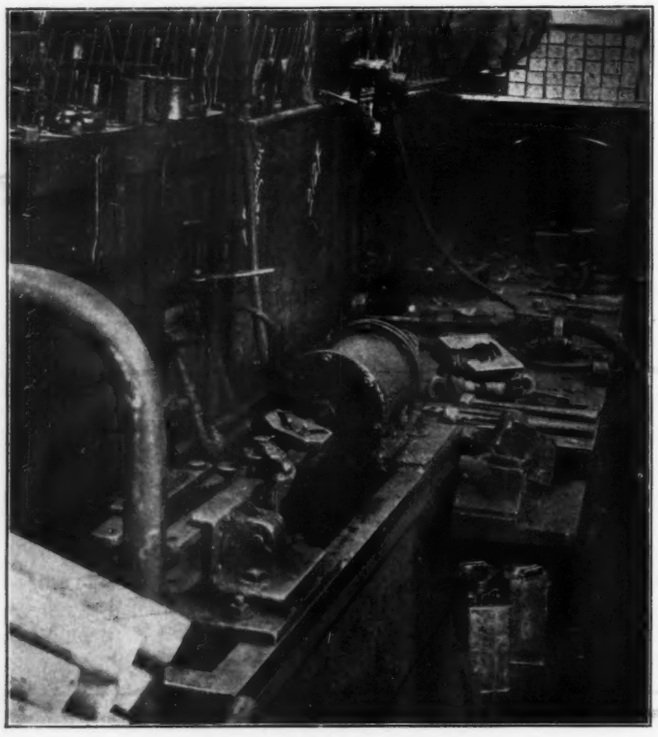


Fig. 10—Brake Hose Repair Bench.

rangement show the possibility for kinks in this department. The small casting just beyond the couplings in the foreground is used for inserting the rubber gaskets in couplings. The casting is held in the vise and the impression provides for holding the coupling in a manner much more easy and quickly than it could be clamped in the vise. Just beyond this casting is seen an air-operated clamp used for closing up the metal clamp which is held together by a bolt. It is difficult to draw these metal clamps together for bolting without some special device, and this design, given in detail in Fig. 11, is probably as effective a device as can be designed for this purpose. Near the vise in the background is shown a clamp formerly used for this purpose, but it was necessary to place it in the vise, by which method much time was lost. The old clamp is still used on occasional odd-size hose, such as used by boiler washers and others about the shops. The locomotive reducing valve, seen on the partition above the bench, provides for cutting down the pressure of the air which comes from the shop main, and at a greater pressure than required for the brake hose work.

AIR OPERATED CLAMP.

The clamp seen on the edge of the bench in Fig. 10 is shown in plan and elevation in the line drawing, Fig. 11. Its use is self-explained in the half-tone illustration, which shows a piece of hose held between the jaws. The 8-in. brake cylinder

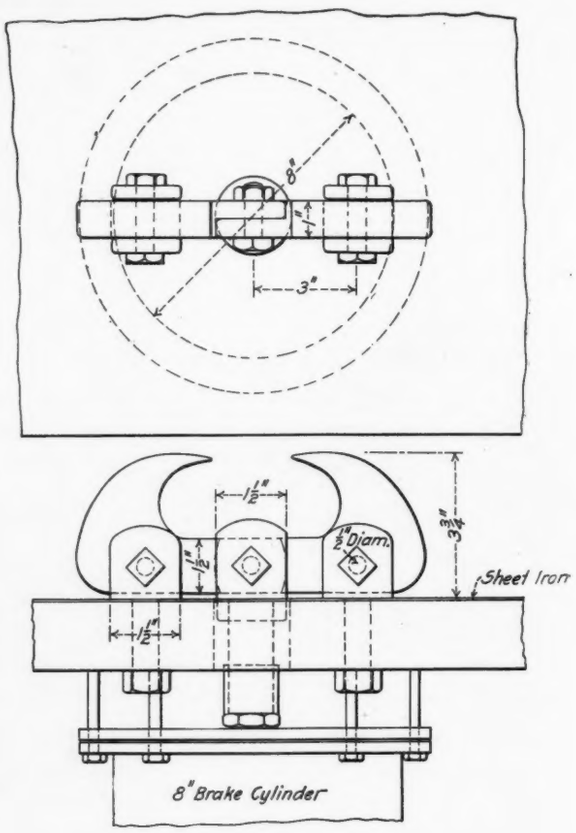


Fig. 11—Air Operated Clamp.

is swung below the bench and the air is controlled by a valve placed to the right just behind the clamp. As only about 2 in. of movement is necessary in the cylinder, a loose piece of pipe is slipped over the piston rod which arrests the downward movement of the cro shead. This provision is important, since the hose often slips, in which case the sharp jaws of the clamp might cut the hose.

TRIPLE VALVE PISTON COMPRESSOR.

The line cut, Fig. 12, shows a clamp used for closing up packing ring grooves in triple valve main pistons. This clamp is bolted to the bench in the position shown in the left hand

elevation. The 3½-in. diameter ram is loosely fastened to the 1¼-in. diameter threaded bolt. It is made loose to permit its seating itself evenly against the piston, which rests in the bored impression in the upper side of the U-shaped base. An improvement in this respect could be made by using a ball shaped connection, rather than the flat one which the device now has.

Before placing the triple piston in the impression which receives it, its packing ring is snapped into position to prevent the groove from being closed too much. The 36-in.

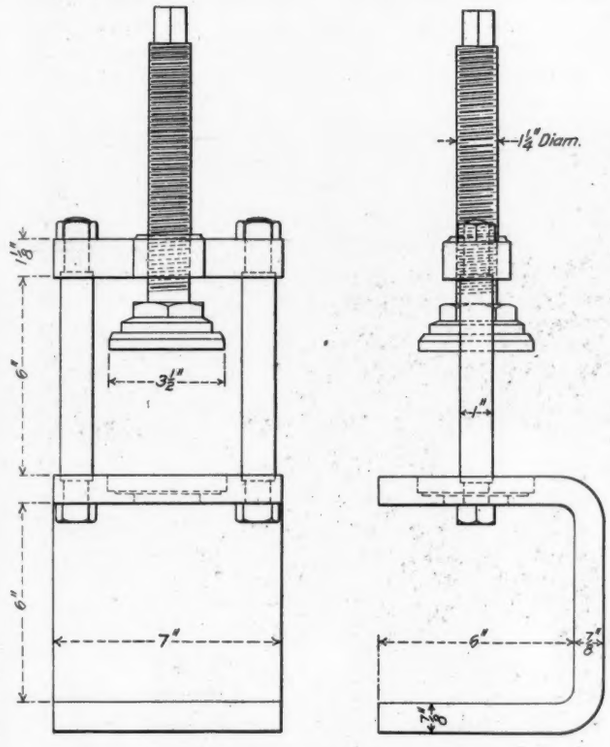


Fig. 12—Triple Valve Piston Compressor.

double end wrench provides a large amount of leverage, so that grooves are easily closed and marks or burrs can also be pressed out. Another advantage could be had by slotting one side of the upper cross bar which carries the screw. This would allow of putting the triple piston in position easily and would save the time which at present is required to run the ram down against the piston.

Blacksmith Shop.

The blacksmith shop kinks of this collection are probably the most interesting and valuable yet presented. The importance of this class of shop tools becomes more and more marked with each shop that is visited and as it is realized that shop foremen devote a large amount of time and study to this part of their departments. Geo. W. Kelly, foreman blacksmith at Elizabethport and president of the International Railroad Master Blacksmiths' Association, has increased the efficiency of his shop to a very decided degree through the designing and installation of a large number of these home made labor saving devices, a number of which are shown.

Thermit welding of locomotive frames and driving wheels has been reduced to a simple but effective process by him, and his statement that over 300 successful welds, of both frames and wheels, have been made at the Elizabethport shops, speaks well, not alone of the process, but of his apparent skill in handling the work. All of this welding is in the foreman blacksmith's personal charge, as it should be in all shops, as these men are certainly best acquainted with the properties of metals, the expansion and contraction of which is a most important factor in obtaining the best results. Preheating is done by the use of a hydro-carbon water gas, a by-product in the manufacture of Pintsch gas for car lighting. Having the Pintsch gas plant on the grounds, the by-product is easily obtained. These Thermit welds cost from $12 to $18 apiece for material and labor, using about 60 lbs. of Thermit for a top rail weld and about 40 lbs. for bottom frame weld.

The bulldozer work shown below gives evidence of the possibility for a high state of perfection in this work, the aim being to reduce the machine work to a minimum and to so equip the machine that every stroke will be utilized to its maximum, thus forming or punching at least two pieces at the same time. To fully explain the action of a particular die and the flow of metal during the forging process, the different stages of the forging are shown, as the blacksmith, to get the full benefit of the description, must know these successive stages.

The frog shop at Elizabethport occupies one corner of the blacksmith shop, and the large new planer, the drill press and several other machines, at first thought, would seem to have been crowded out of the machine shop, which is, however, not the case, as they were intentionally so located that the work could be easily supervised by the blacksmith foreman.

Mr. Kelly was particularly interested in our obtaining shop kinks and extended every possible courtesy, both in fully explaining the devices and arranging them for photographing.

PNEUMATIC SWEDGING AND WELDING MACHINE.

The half-tone illustration, Fig. 14, and the line drawing, Fig. 13, shows a pneumatic swedging and welding machine, which was designed and perfected by G. L. Van Doren, superintendent of shops at Elizabethport.

The frame is made of cast steel, and of very stocky and rigid design. The inside face is 9⅞ in. from the center line of the dies and only 4 in. wide, allowing a wide range of movement on the die blocks. These are made of hammered steel and keyed in position. An old locomotive truck center

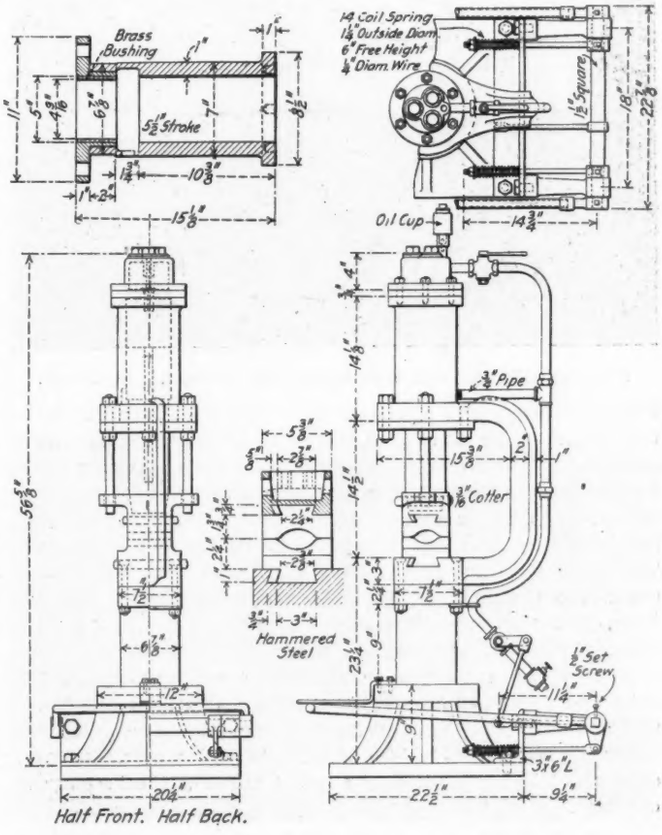


Fig. 13—Pneumatic Swedging and Welding Machine.

casting is used for the base. The air cylinder, as shown in the detail drawing, screws on to a hammered steel collar which is inserted from the lower side of the frame. A $\frac{1}{16}$-in. shoulder on the outside of the cylinder wall and the collar clamp the frame, while the four 1-in. through bolts fasten the cylinder securely. Two of these bolts have $\frac{7}{8}$-in. extensions, which act as guides for the movable die block.

It will be noticed that there are two air supply pipes. The lower one carries the air which finds its way to the top side of the piston through a $\frac{7}{8}$-in. passageway drilled along the center line of the piston, which is made in one piece with the piston rod. Two $\frac{1}{2}$-in. drilled ports lead the air into

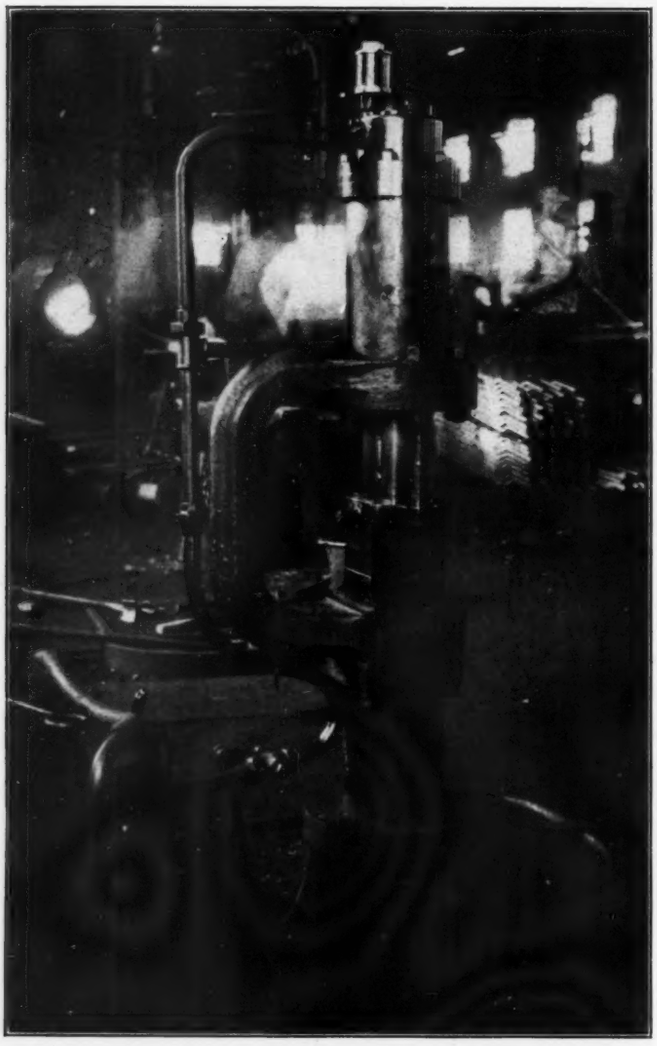


Fig. 14—Pneumatic Swedging and Welding Machine.

this passageway and also exhaust it when the hammer is at the bottom of its stroke, as shown in the illustration. This arrangement was, in the first design, the only provision made for the air supply, and it was later changed to that which is shown. A cast iron valve chamber, having three $1\frac{3}{8}$-in. openings and mild steel valves, was placed on top of the cylinder. The lower stems of these valves are $2\frac{1}{8}$ in. long and extend down into the cylinder, while $\frac{1}{2}$-in. diameter guide rods extend upward into the brass caps which are shown in the plan. When the piston approaches the top of its stroke it strikes the downward extending portions of these valves, opening them and admitting an additional supply of air for the downward stroke. A $\frac{3}{4}$-in. cut-out cock provides for using the lower air supply only if so desired, in which case, however, only about 50 per cent. of the actual value of the hammer is obtained.

There are three of these hammers now in use in the Elizabethport blacksmith shop, as well as in shops along the line. Each is placed near a forge and is used on all kinds of small work in welding from $\frac{3}{4}$-in. to 3-in. round iron and general shaping. The original design was intended for welding truss rods, chain links, etc. The $5\frac{1}{2}$-in. stroke is ample for all this class of work.

Signal or other thin lubricating oil is fed into the cylinder from the oil cup, which is tapped into the valve casing at top of the cylinder.

FORGING MACHINE DIE RACK.

A shop kink is a tool for doing a piece of work with ease and acceleration, but it may also be an arrangement by which tools are stored and handled, which condition is just as important as the tool itself. Under this head comes the

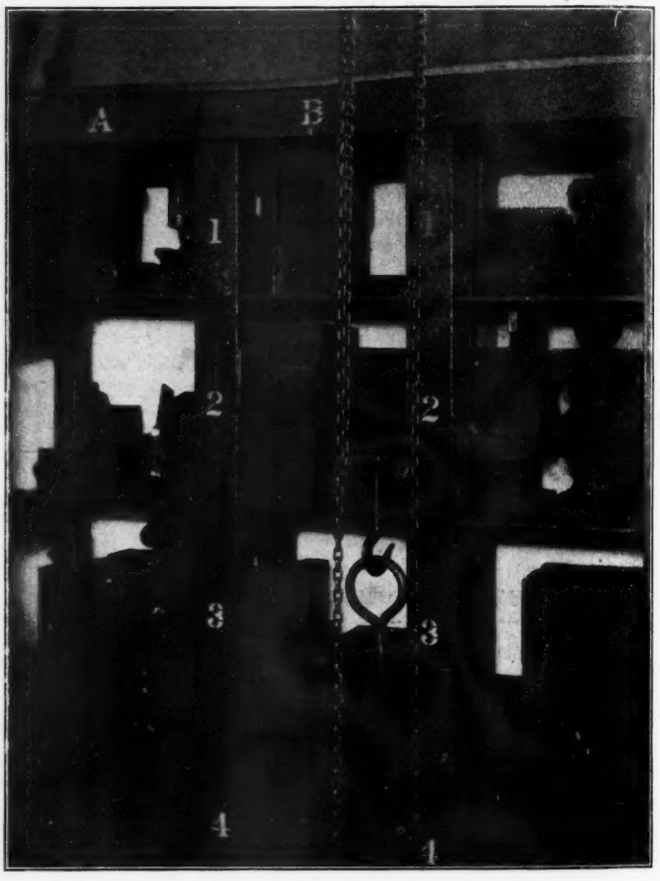


Fig. 15—Section of Forging Machine Die Rack.

forging machine die rack at Elizabethport, a section of which is illustrated, Fig. 15.

The uprights are made of 3-in. x $3\frac{1}{2}$-in. T-section iron, material left over after completing a job for which it was especially made. The shelf rests are made of iron and bolted in place. The shelves are made of $\frac{5}{8}$-in. plates, 7 in. deep, there being two such plates in each compartment, which accommodates two sets of dies for the 3-in. forging machine. The entire rack has 16 vertical sections, lettered from A to P inclusive, and each section has four compartments, in all providing for housing the 128 sets of dies which are at present on hand.

The chain block shown in the illustration is used in handling the dies to the machine, using an overhead track. Each die is tapped for the loop shown, so that very little other handling is necessary.

ECCENTRIC JAW DIES.

The accompanying half-tone, Fig. 16, shows the dies used and the three successive stages of making the jaw ends of eccentric blades. These dies are used in a 3-in. machine and

take the relative position shown. The dies are made of cast iron and the plunger of soft steel. Ranged along the top of the dies are three pieces, showing the stages of manufacture.

The first shape is roughed out under a hammer. It will be noticed that a boss is made on one side to provide metal for the branch arm. The second stage is that of punching the jaw. This is done on any forging machine, after which

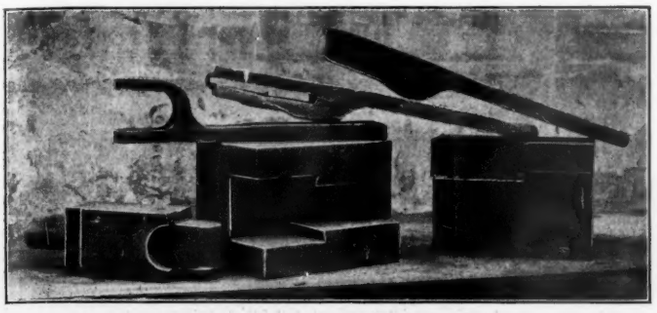


Fig. 16—Eccentric Jaw Dies.

the jaws are spread sufficiently to allow the entrance of the plunger when put in the dies for the final operation. The chalk mark on the upper half of this jaw indicates that portion which is cut off just previous to the final heating. The dies, plunger and final shape explain the third operation, which is the result of a single blow. It is interesting to note that very little machine work is required, this being confined to the wearing and bolt and nut bearing surfaces.

EYE BOLT DIES.

A very interesting pair of dies, with plungers, is shown in Fig. 17, along with the ⅞-in. eye bolt formed. These dies, as well as the plungers, are made of soft steel.

The top impressions, with the plunger shown at the left, are used for the first stage, during which the collar is formed, while sufficient metal enters the plunger to form the eye. The lower impressions, with the plunger shown at the right, finally shape the collar and the boss which entered the first plunger. The central impressions are used without a plunger, their work being that of lateral action only in punching the eye hole. A film of metal, $\frac{1}{16}$ in. thick, remains after this process, and it is removed cold with a single blow of a hand hammer.

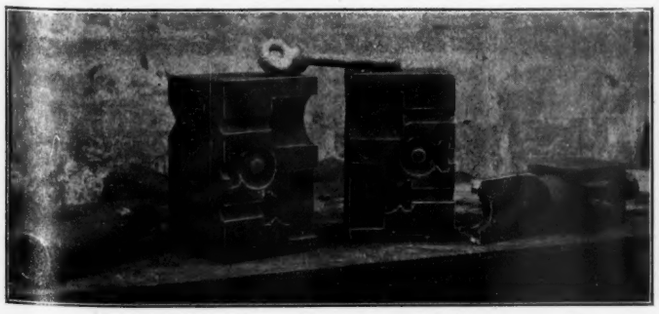


Fig. 17—Eye Bolt Dies.

PATCH BOLT DIES.

The patch bolt dies shown in the line cut, Fig. 18, are interesting as illustrating a method of making a small forging in one combined movement. The assembled view at the right of the drawing, showing position of the dies, the knife and the plunger when the bolt is finished, is almost self explanatory to blacksmiths. The metal is passed through the die plate and the cast steel knife, which shears of sufficient metal for the finished bolt and continues the movement which places the stock in line with the cast steel plunger. The finished bolt is thrown from the dies by a kicker pin which passes through the ⅜-in. drill hole in the knife. This knife is made of cast steel and is circular in shape, being successively revolved into a new position as the cutting edge becomes worn. The set screw shown in the die plate holds the knife in position.

The drawing shows the original design, which has been changed somewhat by bolting high speed steel strips on the top of the dies, providing a counterbore which the plunger enters rather than merely meeting the flat surface as shown in the drawing.

These dies are used on a 1½-in. Acme heading and forging machine. It is important that the correct diameter metal be used with such dies, following being the ruling in this case: Use 15-16-in. round iron for making a bolt to be sized for a 1 3-16-in. diameter tap and having a 13-16-in. square end, and use 1 1-16-in. round iron for bolts to be sized for 1 3-16-in. to 1⅜-in. diameter taps and having 15-16-in. square ends.

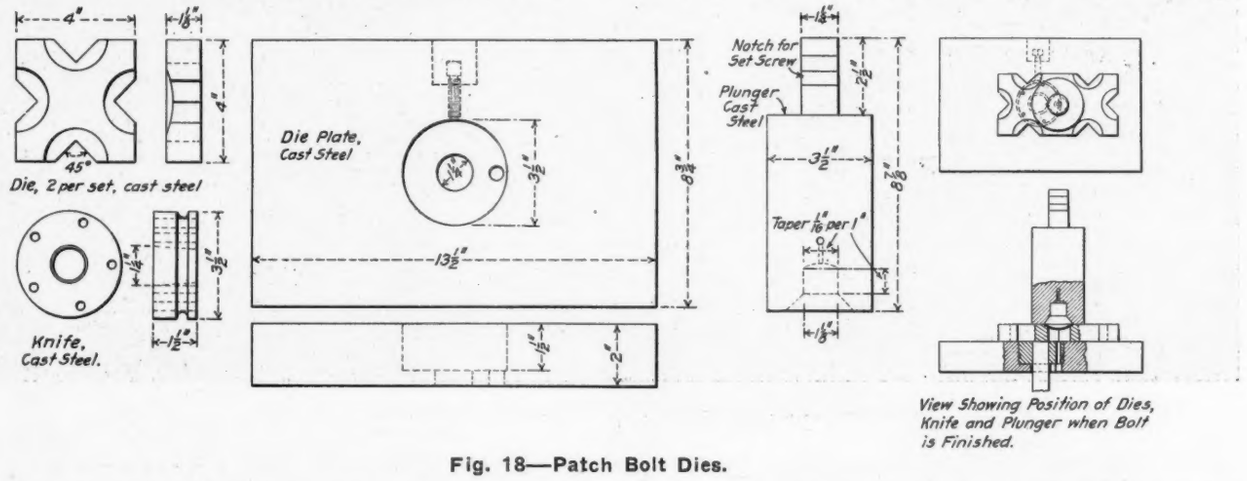


Fig. 18—Patch Bolt Dies.

FOOT FORMING DIES.

An object lesson in the flow of metal during a die forging

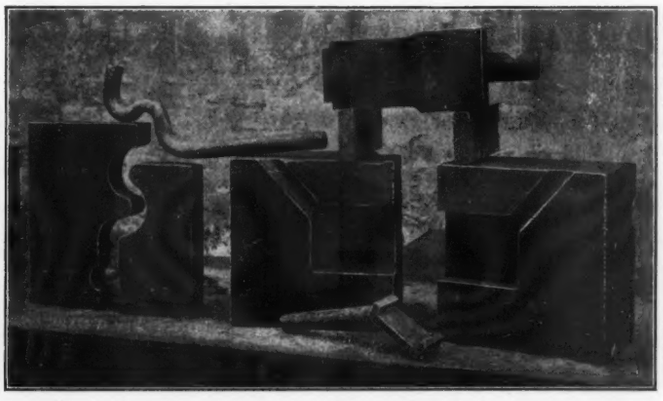


Fig. 19—Foot Forming Dies.

process is well illustrated in the half-tone, Fig. 19. This forging, made from 1¼-in. round iron, is used for the lower foot of a passenger car pedestal strap brace, but this same general shape is used in a variety of instances, both in car and locomotive work.

The bending dies, shown at the left, are used in forming the round iron into the triple-bend shape. These dies are clamped on the top of the main dies, the half circular section of the lower portion of the extreme left-hand dies being made only to clear the oblique circular impression in the main die. This three-bend shape was gotten by a series of trial shapes, it being probably easier to get it in this way than by calculation of the metal flow. After this preliminary shape is gotten, the metal is returned to the furnace for a welding heat, at which time it is made into the final shape shown, using the plunger.

PNEUMATIC BENDING MACHINE.

The accompanying half-tones, Figs. 20 and 21, show two views of a pneumatic bending machine, which was originally designed by F. F. Hoeffle, master blacksmith, Louisville & Nashville shops at South Louisville, Ky. Mr. Hoeffle's design provided for a single cylinder, larger than the 12-in. x 14-in. ones shown. This tandem cylinder arrangement has been made up for another purpose, but was used in building this machine, and gives much more power than would the single cylinder.

This machine has just recently been completed and the dies for it are now being made. The front view shows an arrangement for forming the eyes of the long link shown. It is intended to use this machine for forming the freight car hooks shown, the hook end of which will be made on the now vacant side of the movable head and bed. The machine will then form the opposite ends of the two hooks at the same movement.

It will be noticed that the machine is made of scrap material. The discarded locomotive frame makes an excellent framing for the machine. The equalizing arm arrangement serves to evenly distribute the cylinder thrust and to guide the cross-head. The extension gives an operator easy control of the air from his position in the front of the machine.

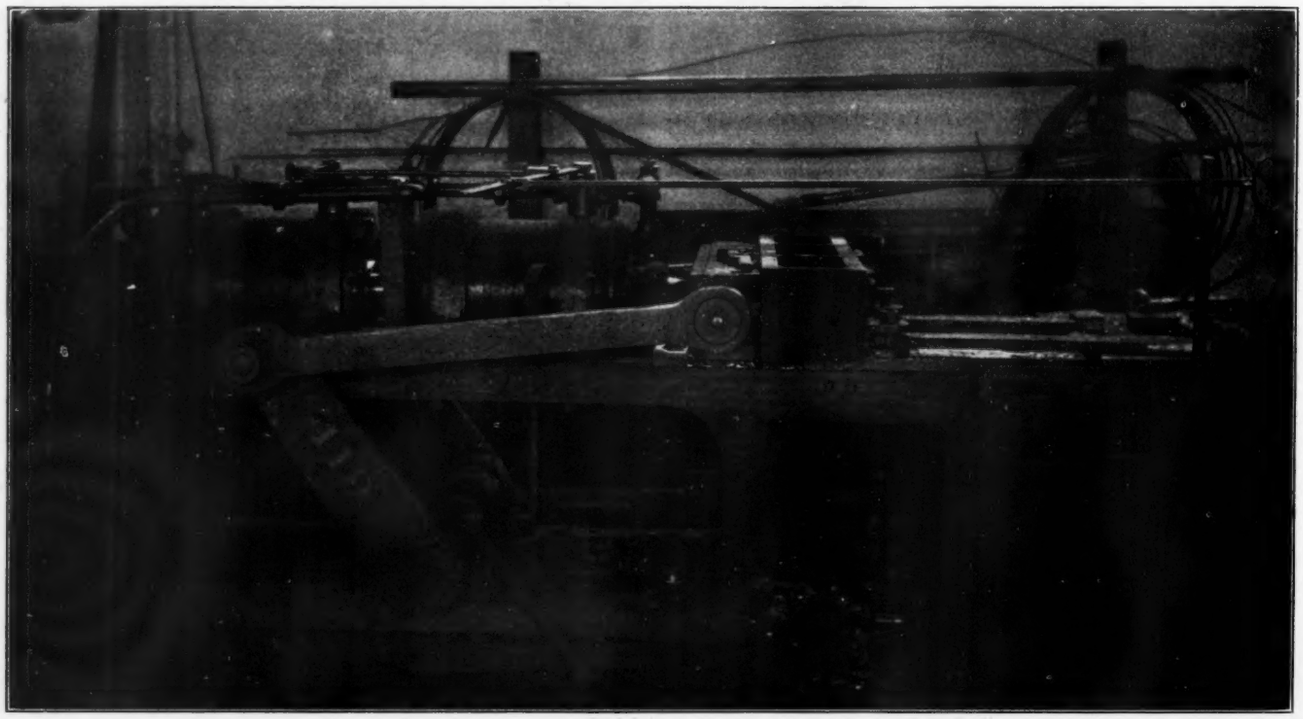


Fig. 20—Pneumatic Bending Machine.

Fig. 21—Pneumatic Bending Machine.

BENDING AND PUNCHING MINER DRAFT RIGGING YOKES.

In the accompanying half-tone, Fig. 22, is shown an ar-

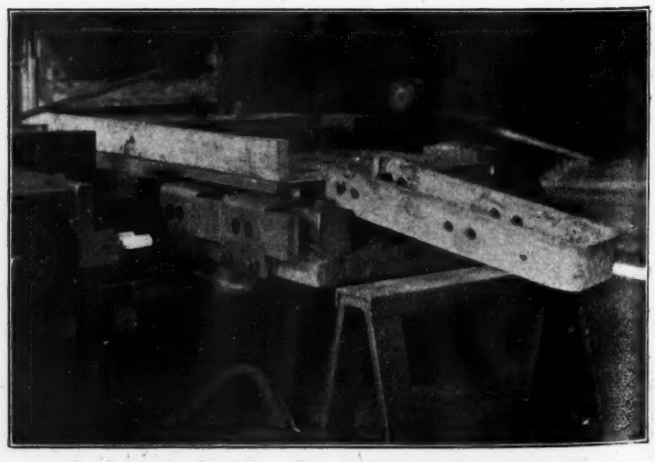


Fig. 22—Machine for Bending and Punching Miner Draft Rigging Yokes.

rangement on an Ajax bulldozing and bending machine for bending and punching Miner draft rigging yokes made from 1-in. x 5-in. iron.

The shoulders, on the open end of the yoke, for gripping the coupler shank are upset on a forging machine, after which the center end plate hole is drilled or punched. After heating, the plate is placed on the bed of the machine, the end plate hole taking a pin in the end of the bending block, which is bolted in place. After bending, the yoke is inserted between the stripping plate and block shown for punching the four large holes. The yoke is then reversed for punching the four holes on the opposite side. The stripping plate is made loose, so that it acts as a straightener also, taking out the flare which is left after the bending operation, as the bending die is only about half the length of the yoke.

The plan of utilizing each movement of the machine to full capacity is used in this process, since while one yoke is being bent by the bending dies another yoke can be punched at the same stroke. In order to avoid having the combined shock of the bending and punching come upon the machine at the same time, the punching takes place near the end of the machine's stroke and after the bending shock has passed. The punches, also, vary ¼-in. in length, which serves to distribute these shocks.

The capacity of this machine depends upon the heating facilities. The 4-ft. 4-in. x 9-ft. oil furnace, with full width door, is seen in the background and near the machine. Under ordinary conditions this machine will handle 100 yokes per day.

BENDING SPRING SEAT STIRRUPS.

Spring seat stirrups for freight car trucks are formed on the Ajax bulldozing and bending machine with the dies shown in position in the half-tone illustration, Fig. 23, and in the line drawing, Fig. 24. The male die is bolted to the face plate and rests against the end stop of the machine, while the female

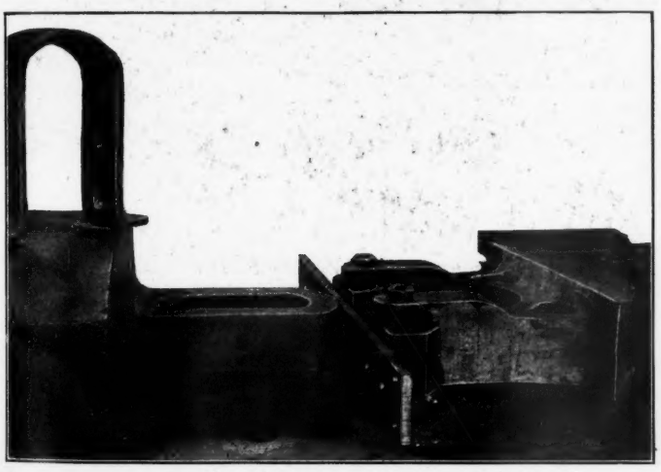


Fig. 23—Machine for Bending Spring Seat Stirrups.

die is bolted to the movable head. The holes in the stirrups are first drilled and countersunk, after which the plate, 1-in. x 6-in., is placed in the furnace. The half-tone illustration shows one of these plates in position just before bending. The small drilled hole in the center of the plate takes a pin on the male die.

Making these stirrups on this machine presented a problem which was met in a decidedly novel way, and at the same time adding a feature to the dies which very materially assists the metal in taking the new form. This problem lay in the fact that the travel of the machine was about 3 in. less than the length of the finished stirrup. Reference to the line drawing shows the two extreme positions of the movable blocks which were placed on the ends of the female die. The dotted lines in the drawing and the half-tone illustration show the positions which these blocks assume at the beginning of the operation, while the solid lines show their final position. As the dies close together, these revolve on the 1¼-in. bearings, and the flat surfaces of the blocks present two 10½-in. movable sur-

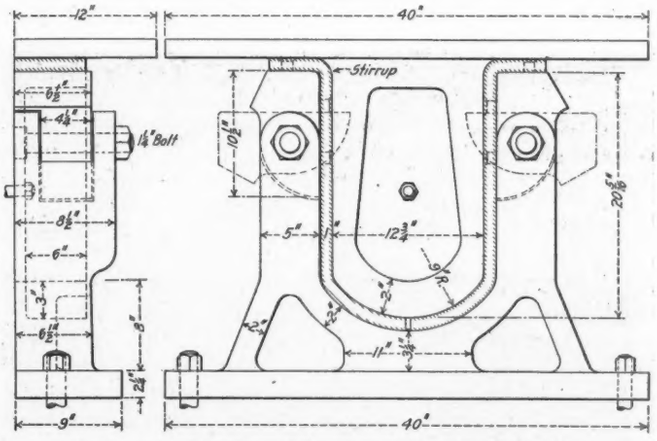


Fig. 24—Details of Spring Seat Stirrup Dies.

faces to bend the iron, which is an advantage over the metal's bending against the corners of the die.

FORMING EQUALIZERS UNDER STEAM HAMMER.

The half-tone illustration, Fig. 25, shows a portion of a 4,000-lb. Chambersburg steam hammer in the blacksmith shop at Elizabethport and the way in which it is used for forming passenger truck equalizers using cast steel dies.

The bars are first cut to length and their ends shaped as shown by that end which is under the hammer in the illustration. Two heats are necessary for this work, one for each end. One end of the bar is then returned to the furnace and when sufficiently heated, it is placed in the lower die and clamped in position as indicated. The movable die, seen above, is then brought down, forcing the end into the die

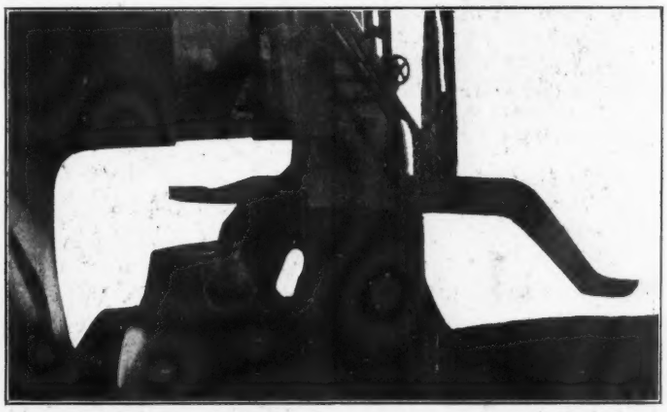


Fig. 25—Forming Equalizers Under Steam Hammer.

below. This lower die has upward extending flanges, between which the metal is held and prevented from slipping. The opposite end of the equalizer is then treated in a manner similar to the first, four heats in all being required for completing the bar.

These bars are made from 2-in. x 7-in. metal at a saving of much more than 50 per cent. in labor and fully 100 per cent. in time. In most cases, when equalizers are forged into shape, it is necessary to machine the $\frac{3}{32}$-in. taper of the ends which takes a horizontal position along the top of the journal box when the bar is loaded. This is provided for by these dies, and the only machine work necessary is that required for the cast circular ridge on the top of the box.

BENDING UNCOUPLING RODS.

The half-tone illustration, Fig. 26, shows an arrangement by

which uncoupling rods or pin lifters are shaped on the Ajax machine. This attachment operates on two lifters at the same time, the four center bends being made as indicated by the partially completed rod seen on the face plate and extending around the die block, while the two end bends are made as

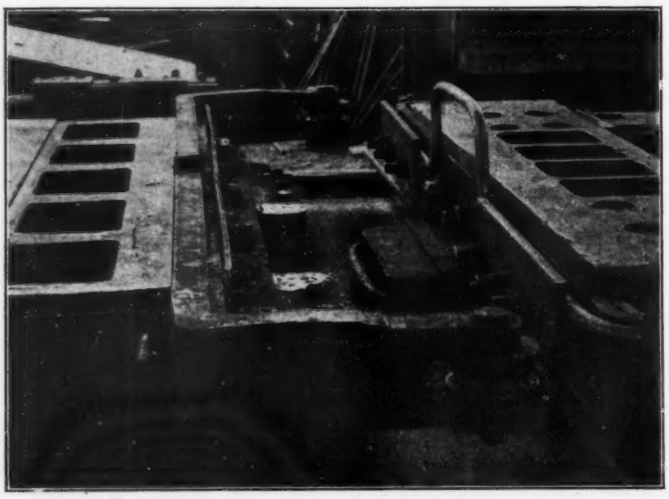


Fig. 26—Machine for Bending Uncoupling Rods.

indicated by the completed rod shown near the top of the stationary block of the machine.

These rods are made of 1-in. round iron and bent cold. All bends are made against grooved rolls, and the cold metal takes the new form much more easily than it would were these grooves rigid, in which case a good amount of friction would result. The rod which is taken from the lower position and moved to the upper for the final bends is not rigidly clamped in position, but merely placed along the space blocks. When the rolls meet the round iron, they hold it firmly in position.

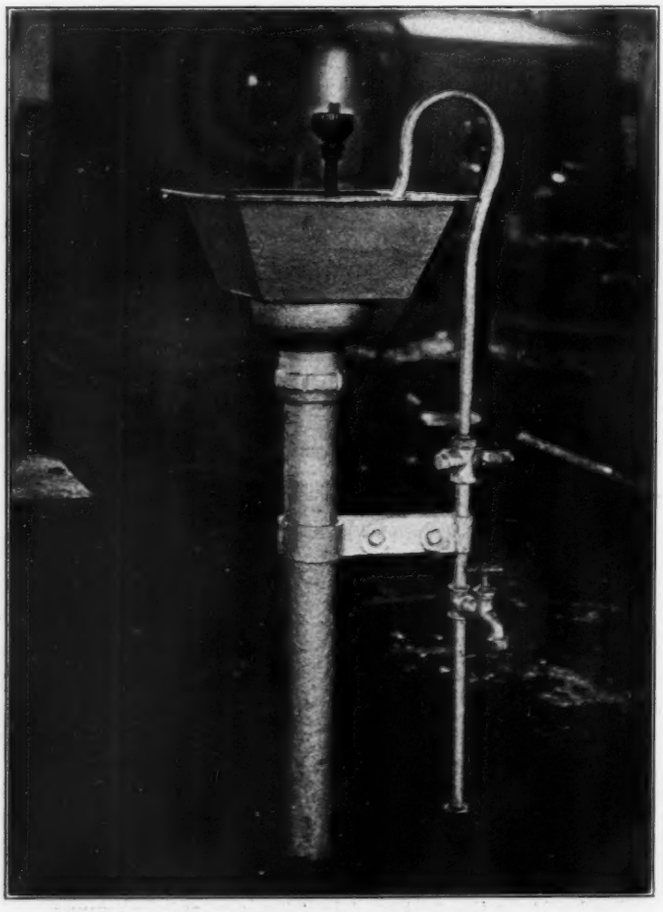


Fig. 27—Drinking Fountain.

DRINKING FOUNTAIN.

In the accompanying half-tone, Fig. 27, is shown a drinking fountain, two of which are in the blacksmith shop and a number of which are distributed through the other shops. The one shown is placed near the center aisle of the blacksmith shop, where it is easily accessible and at the same time affords no excuse for time being lost when men congregate about such a place. The water used in these fountains is obtained by air pressure from a 300-ft. well on the shop grounds.

The bowl is made of cast iron. The spigot, seen on the feed pipe, provides for filling buckets for general use.

THERMIT FRAME WELDING.

The use of Thermit for frame welding has, during the past few years, demonstrated the fact a frame can be permanently welded in place on a locomotive, and that the section thus welded is easily as strong as, and in most cases stronger than, the original section. The making and repairing of locomotive frames has been the subject of no little discussion and study by railway mechanical departments.

The illustration here given, Fig. 28, shows a steel frame section Thermit-welded to the frame in position under the locomotive when it was in the back shop for light repairs on March 7, 1907. This locomotive is at present in service with the same frame in perfect condition, which shows the value of the weld. These steel sections are now being applied to all of this class engine when they are shopped, and up to the present time 31 engines have these Thermit-welded sections, 15 of

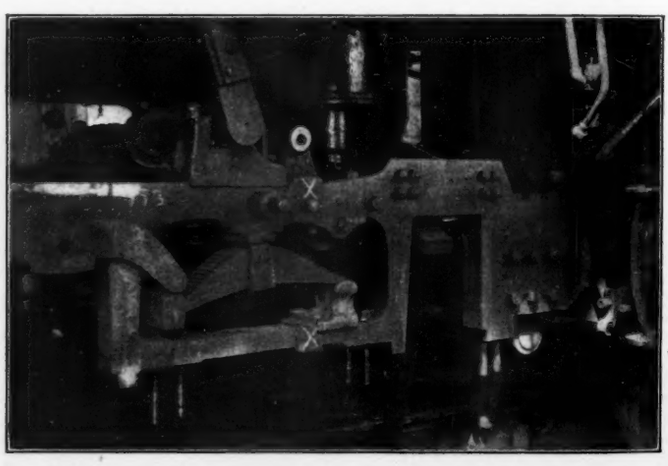


Fig. 28—Steel Section Welded to Frame in Position with Thermit.

which are thus equipped on both sides. Their application is made in the following manner: After the old section is cut away the steel section is bolted in position, with from ¾-in. to 1-in. open space between the abutting ends to allow for a free flow of the Thermit. The frame is trammed for its final position and then jacked long of the tram marks from $\frac{7}{32}$-in. to ¼-in., which is later taken up again when the Thermit contracts on cooling. Short steel wedges are then driven between the adjoining ends of both rails to hold them in position, after which the jacks are removed. A wax collar, from ¾-in. to 1-in. thick, and overlapping from 1½-in. to 2-in. on each side of the opening, is then applied to the top rail. The bottom half of the mold box is then adjusted and a spreading bar, extending between the backs of the adjacent frame legs, is put in place and held by a wedge during the preheating of the section to be welded. This preheating takes from an hour to an hour and a half, according to the size of the frame, which must be brought to a white or fusing heat. A 75-lb. crucible, with a ½-in. tapping hole, is swung above the frame

and directly over the pouring gate of the mold. When the frame is sufficiently heated, the fire is turned off, the jet pipe removed and the ignition powder lighted. After the Thermit has become set, the spreading bar is removed and the lower rail welded in the same manner as the upper one.

The entire process of Thermit welding requires that it be properly handled, but it is also very important that due allowance be made for shrinkage and releasing of the strains which are set up in the frame. To relieve these strains, the forward leg of the second jaw is heated after the weld has cooled.

Thermit frame welding was begun at Elizabethport in January, 1905, and up to the present time about 300 welds of all kinds have been made, with no failures of welds, although failures have occurred in both old frames and new steel sections adjacent to the Thermit welds. Previous to August, 1906, all welds were made without preheating, as the 5,400-deg. Fahr. heat of the reaction was considered sufficient to perfectly amalgamate the metals. Since this date, however, preheating has always been resorted to and the result has always been much more satisfactory. There are at present several locomotive frames in service having as many as five and six welds.

Boiler Shop.

The boiler shop at Elizabethport occupies one end of the same building in which the erecting and machine work is done. The longitudinal pit tracks of the erecting shop extend the building's entire length and the portion of the boiler shop having these tracks is used for doing the tank work.

Fig. 30 shows, in the background, the office of Frank Craig, foreman boilermaker. The office space extends just past the third window, where there is a partition dividing the office and tool room. All the boiler-making tools are kept in this tool room, which is much better than having them kept in the general tool room. All air hammers for chipping and calking, when not in use are partly submerged in a tank of oil which keeps them in condition and prevents the valves from sticking on account of rust from the moisture in the air.

Safe-end flue welding in this shop in a small building adjoining the main building. Geared to the shaft carrying the flue cutter is another parallel shaft which carries a tapered reamer. After the end of the flue is cut off, the new weld end is reamed. As the safe-end pieces are tapered off, the weld is made with two tapered surfaces rather than one, which seems to give better service and makes a longer weld. It is the policy in this connection to reduce the number of welds on the flue as much as possible, and one safe-end, 24-in. long is used in place of two shorter pieces.

In the boiler shop kinks, as well as in those of other shops, the use of old freight car brake cylinders is noticeably evident.

BLUEPRINT FILING CASE.

The accompanying half-tone, Fig. 29, shows a blueprint filing case in the boiler shop, in which are filed all the working blueprints required in this shop. The case is substantially made of wood, with four wooden partitions, which act also to strengthen it, while the vertical partitions are made of light sheet iron. It will be noticed that the partitions are numbered serially from 1 to 46. When made it was the intention to keep a card index of the prints, but this was later found unnecessary, as the men very soon got to know the sizes of the various drawings and could locate a print direct, knowing its size, about as soon as by the use of a card index. Each print is mounted upon heavy cardboard and varnished over, both of which preserve the prints as well as make them most available for use in the shop.

FLUE SWEDGING MACHINE.

The flue swedging machine shown in Fig. 30 is easily and cheaply made from old material. The bed is made of a 13-in. channel section, about 10 ft. long. To one end of this channel is bolted the upright which holds the air cylinder used for clamping the flue. The second cylinder is mounted horizontally at the opposite end of the bed plate. On the end of the piston rod of this second cylinder are screwed the formers, either the one shown, for swedging down the firebox end of the tube, or the pin former for expanding the ends of flues for large holes rather than to use a ferrule.

An oil furnace is placed near the machine for heating the tube ends. When placed on the V-block the air is turned on. The piston in the vertical cylinder responds first, thus clamp-

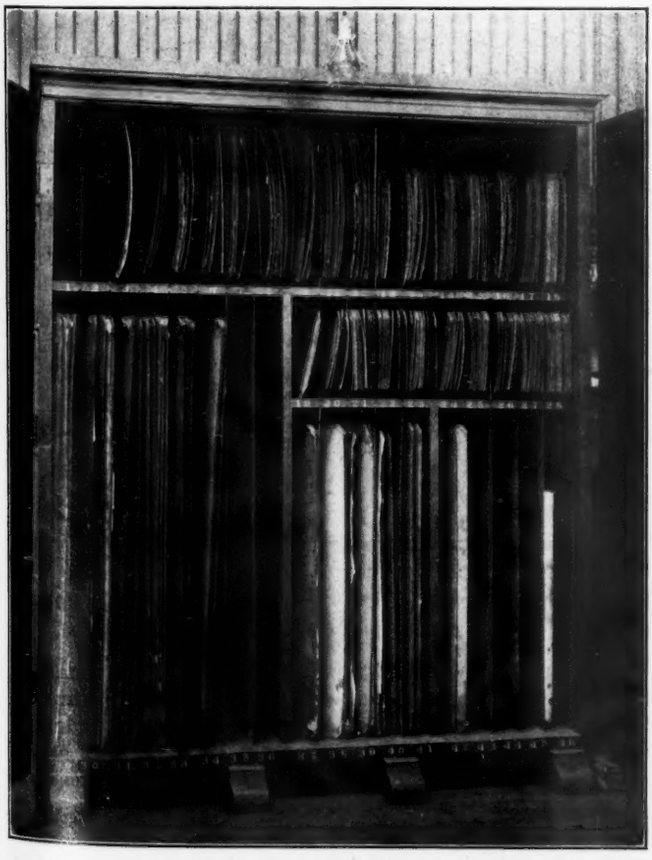


Fig. 29—Blueprint Filing Case.

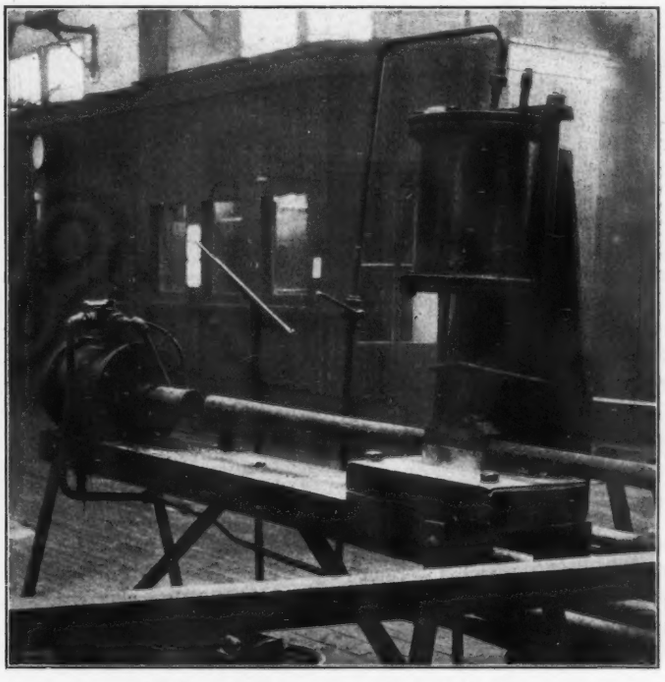


Fig. 30—Flue Swedging Machine.

ing the tube in position, after which the piston of the second cylinder acts to move the forming die against the end of the flue.

FLUE TESTING MACHINE.

In Fig. 31 is shown an arrangement for cold water testing flues which have had new safe ends welded on them. The set of flues seen on the buggy show that 24-in. safe-ends have just been welded. At the extreme left of the illustration is seen the plunger against which one end of the flue is held, while the near view of the right end of the machine, Fig. 32,

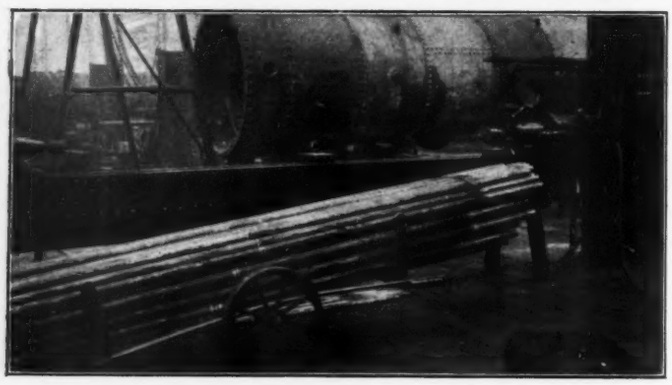


Fig. 31—Flue Testing Machine.

Fig. 32—Near View of Operating End of Flue Testing Machine.

gives a very good idea of the plunger cylinder arrangement and the water supply.

The bed of the machine is made with two metal plates, riveted to the feet. The semi-circular bottom binds the vertical plates together, making a tank into which the waste water falls.

The flues are handled from buggy to buggy, one being placed on each side of the machine. This saves the time of loading.

DEVICE FOR REMOVING MUD RINGS.

The device shown in the perspective line drawing, Fig. 33, illustrates a method of using two heavy bars of iron, a round iron link and a jack for removing a mud ring. Although the rivets are all removed the ring is far from being released, as it is held by the clamping action of the side sheets as well as by the rust and scale which has accumulated. Unless some continuous strain device, such as the one here shown, is used it is necessary to drive the ring down with hammer blows, but this usually results in damaging the corners of the ring and partially closing the bolt holes.

After the rivets are removed and sections of the box cut out at the corners, as shown, the lower 3-in. x 4-in. x 36-in. bar of iron is put in position, one end being rested on the mudring and the other on a block of wood. A hydraulic or screw jack is then placed near the mudring end, when the top bar of iron, with the downward extending arm is put in position, the hooked end gripping the sheet and the other

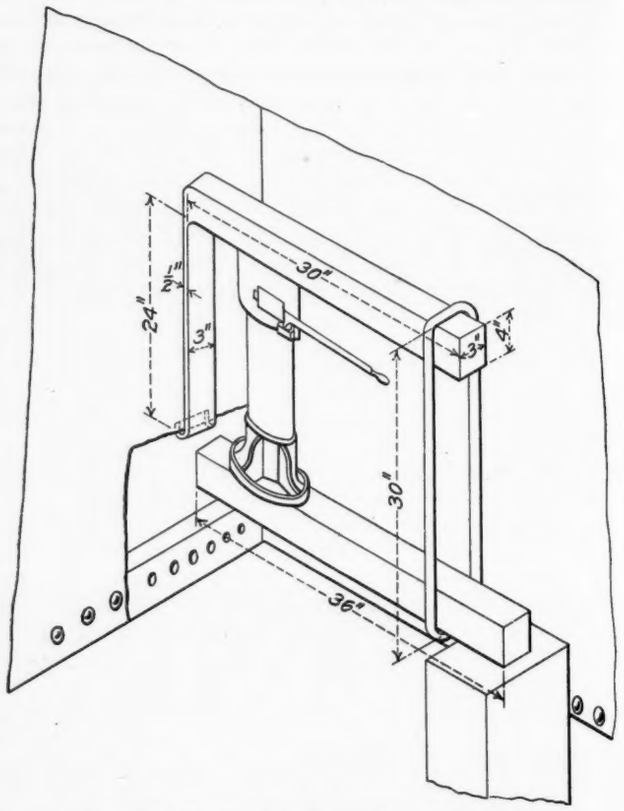


Fig. 33—Device for Removing Mud Rings.

end being run in the loop. The mudring is then easily jacked down about ⅜-in., and as each corner is handled in a similar manner, the ring is then easily removed.

HOLDER-ON FOR TATE BOLTS.

The accompanying line drawing, Fig. 34, shows an attachment to a Boyer pneumatic holder-on for use in connection with riveting Tate flexible staybolts. The regular Boyer holder-on, as designed for these bolts, is used, with the addition of a stirrup which passes around the holder-on, the one

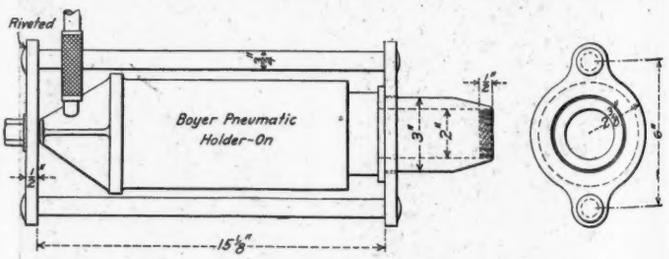


Fig. 34—Holder-On for Tate Bolts.

end of which is rigid with it while the other end makes a loose fit over the collared bushing. This bushing is threaded for screwing on the cap threading. When the air is admitted to the holder-on, the ball end of the plunger moves to a solid bearing on the round head of the bolt and forces the holder-on away from the bolt, which action is transferred to the bushing and threads of the bolt cap, resulting in a self-supporting hold-on, against which the staybolt may be riveted

over on the inside of the firebox in the usual manner.

This work is handled by two men, the one inside the boiler doing the riveting, while the man on the outside shifts the holder-on as the bolts are riveted. While riveting is going on, during which time he is not engaged in handling the holding device, he places the caps on the bolts. As this work is paid for on a piece-work basis, much time is saved in this way.

STAYBOLT BREAKER.

The staybolt breaker shown in the line drawing, Fig. 35, may not differ greatly from other breakers of this general design, but it is given here with the belief that some feature of it may be of advantage to those using this style of breaker.

The barrel is made of steel tubing, 4-in. inside diameter. The ram or plunger is 12 in. long and made loose running in the cylinder bore. Two ¼-in. thick packing leathers are used with flanges turned in opposite directions. These leathers are held between two 3-in. diameter, 5-16-in. thick washers, the whole being held in position on the back head of the plunger by a ¾-in. tap bolt. The hammer end is 9 in. long over all, and is screwed to the barrel on standard threads, 10 per in., by using a spanner.

For using, the breaker is swung in position, a block and fall being used to hold it against the chisel. After a blow, the handle of the 3-way cock is drawn back into the position shown. When this valve is first moved, air enters the forward end of the cylinder to return the plunger preparatory for another blow. The backward movement of the valve handle also causes a collar to move backward and expose 8 ½-in. drilled holes which release the air in the front end of the cylinder, while that at the rear end exhausts through the 3-way valve.

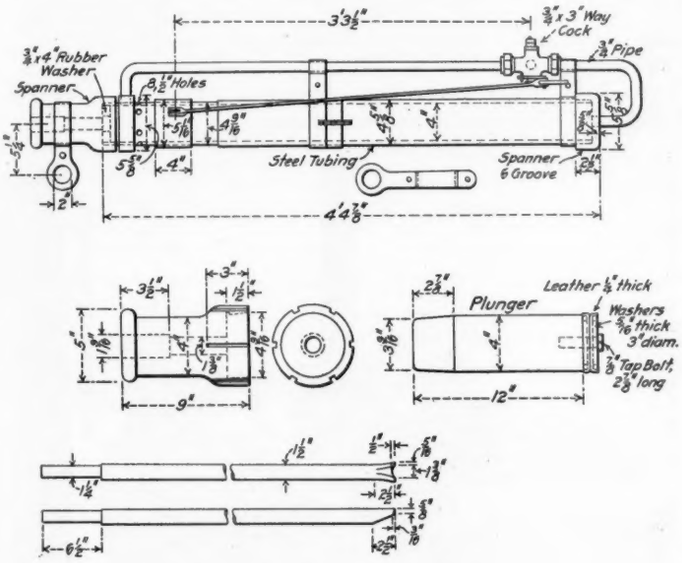


Fig. 35—Staybolt Breaker.

Machine Shop.

The machine shop kinks given in this collection show devices which should easily find their way into every such shop. The method of repairing cylinders which have cracked in the live steam passage is the greatest single money-saver and its real merit is certainly demonstrated by the fact that 61 pairs of cylinders have been saved from the scrap-heap by it. The eccentric drilling jig is a kink of much merit, as is the small bolt centering machine which prevents the loss of a large number of centering drills ordinarily broken by apprentice boys to whom this work generally falls. N. H. Hawkins is machine shop foreman and is particularly interested in shop kinks, and especially in the method of repairing cracked cylinders which has been used with such very good success in this shop.

ECCENTRIC DRILLING JIG.

The line illustration, Fig. 36, shows the details and the half-tone, Fig. 37, the general appearance of a jig for drilling the bolt holes in the halves of split eccentrics. The jig is placed on the drill press bed in the position shown. The half-eccentric is placed on the cams, planed face upward.

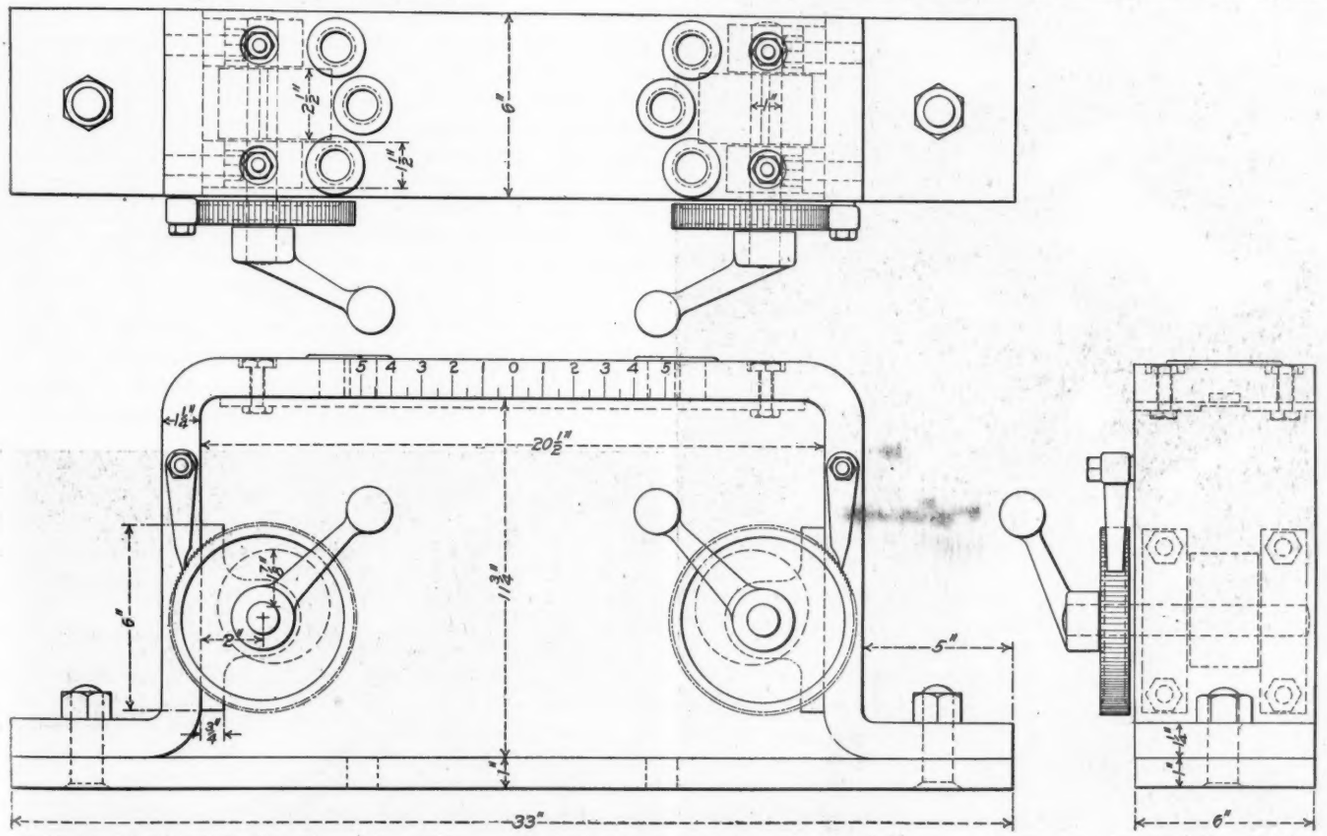


Fig. 36—Details of Eccentric Drilling Jig.

The levers are then raised until the planed surface is in contact all along the under side of the top bar of the jig. The latch dogs provide for holding the cams in position. The half-eccentric is centered up by the graduations shown in the line drawing, when the drill is fed down through one of the bushings in the top bar of the jig, no laying off of holes being necessary. It will be noticed that a plate is seen—in the

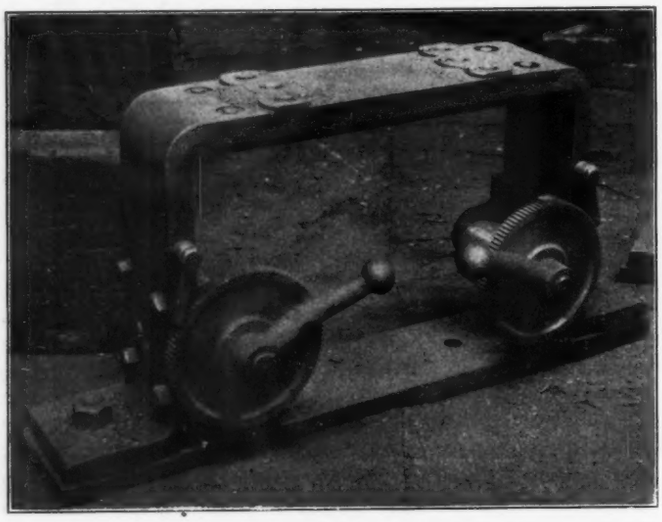


Fig. 37—Eccentric Drilling Jig.

half-tone illustration and dotted in the line drawing—bolted to the under side of the top bar. Reference to the end elevation in Fig. 36 shows this plate to have a wider groove than does the under side of the bar itself, which provision is necessary to provide for different style eccentrics.

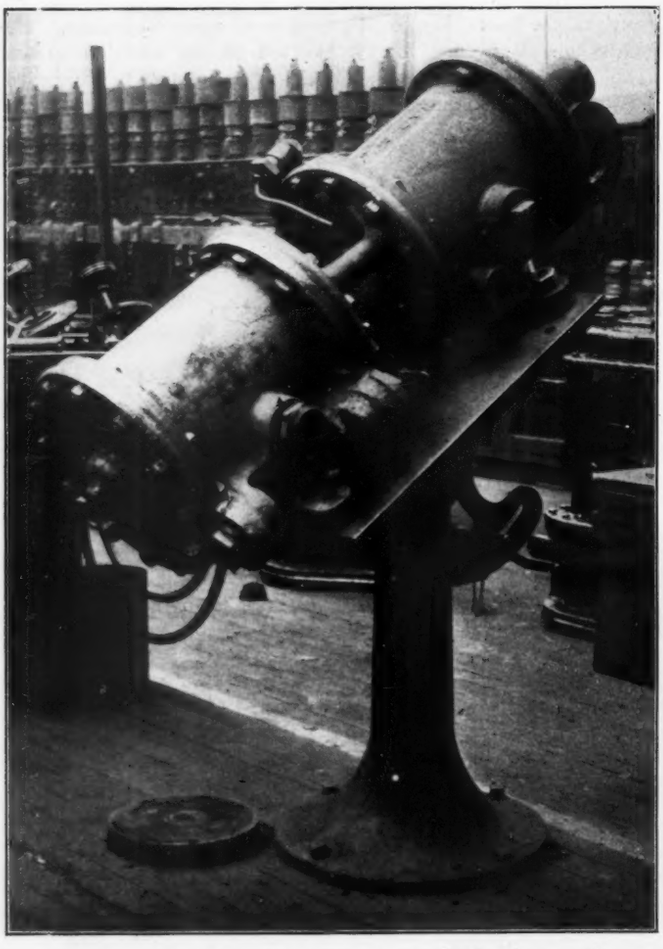


Fig. 38—Air Pump Repair Table.

AIR PUMP REPAIR TABLE.

The illustration, Fig. 38, shows an air pump mounted upon an adjustable table in the repair shop. The feature of this arrangement lies in the table's being designed to be shifted and clamped at any angle. The base and upright are made integral of cast iron. The quadrant is also of cast iron, while the table top is formed with two wrought iron plates.

The illustration is fully explanatory, and the advantages of this table at once appeal to the man who has had to work on an air pump witnout any arrangement for convenience in working.

BOLT-CENTERING MACHINE.

Fig. 39 shows a bolt-centering machine used at Elizabethport. The necessity for this machine arose through the fact that the bolt-centering work is usually done by green apprentice boys, who would continually break centering drills. The machine had a long lever feed, which allowed excessive leverage, resulting in broken drills.

In the present design the drill is fed into the bolt by air pressure. The three-way valve fastened to the upright plate

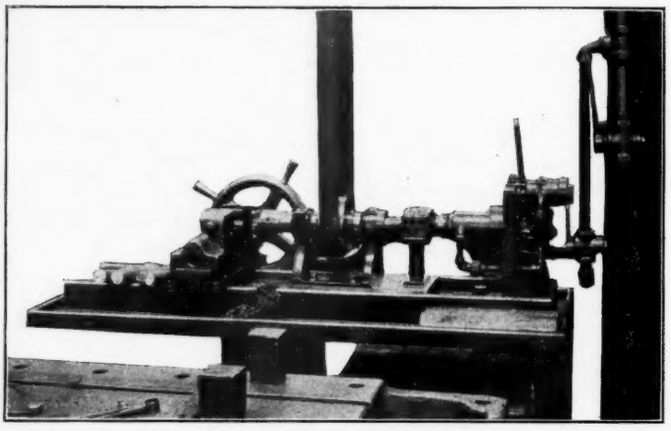


Fig. 39—Bolt-Centering Machine.

at the right-hand end of the machine is the same as used in a locomotive cab for controlling the air which operates the water scoop. When the air is admitted it exerts a steady and sufficient pressure against the drill to feed it into the metal. When the drilling is completed the handle is thrown over, releasing the air behind the piston and at the same time admitting air in front of it to withdraw the drill.

The machine is seen to be made from scrap pieces which may be found about any shop.

BABBITTING CORNER.

The corner of the machine shop which is devoted to the babbitting work is shown in the half-tone illustration, Fig. 40. In the center of the illustration is seen a turntable, around the edge of which a large number of boxes or crossheads are

Fig. 40—Babbitting Corner.

placed. These are, of course, previously made ready to receive the molten metal. In the background is seen the square metal box used for heating driving box hub surfaces previous to pouring the metal. Just above this box is the smaller one which is used for heating crossheads before pouring the metal. The pouring is done on a number of pieces at a time by revolving the table and stopping it as each piece comes into position in front of the heating ladle, shown at the left of the illustration.

After driving box journal bearings have been spotted to the journal they are returned to the man who does the babbitt work, who puts a thin coat of tin over the entire crown of the bearing. This plan was adopted first on the heavy engines, the journal bearings of which very often run hot just after leaving the shop. The tin prevents heating by presenting a very soft wearing surface to the new journal and allowing its more gradual accommodation to the bearing.

SHOE AND WEDGE PLANER TOOL.

A heavy planer tool for shoe and wedge work is shown in Fig. 41. New shoes and wedges at Elizabethport are planed first on the inner faces, after which they are clamped to long planing bars from which they are not removed until completed. The tool here shown is used for truing up the inside flange faces, doing the work complete with a single tool.

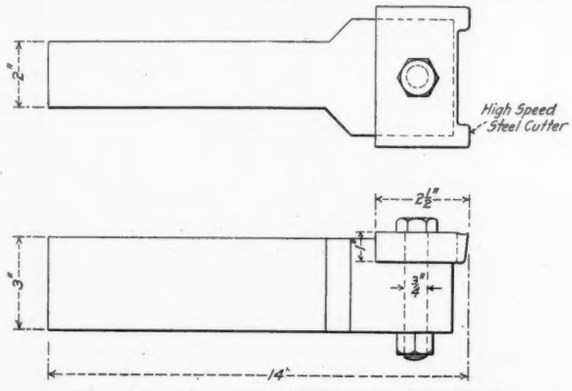


Fig. 41—Shoe and Wedge Planer Tool.

The cutter is made of high speed steel and held in place against a shoulder and with a ¾-in. bolt. One of these cutters may be used continuously for a week without redressing, and the grinding which would be required in that time is done on the bottom surface only, which does not affect the width of the cutter, which is the important point.

REPAIRING CRACKED CYLINDERS.

When a cylinder casting cracks in the live steam passage between the steam pipe joint and the valve chamber and the steam is allowed to escape from the live steam passage before it reaches the valve, the half cylinder saddle is useless unless it can be repaired. The accompanying cross-sections, Fig. 42, illustrate a method of reclaiming such cracked cylinder castings. The first application was made by G. L. Van Doren, superintendent Elizabethport shops, in February, 1907, and this was probably the first application of its kind. Since that time, some 61 pairs of cylinders have been repaired in this way at Elizabethport, none of which have given any trouble.

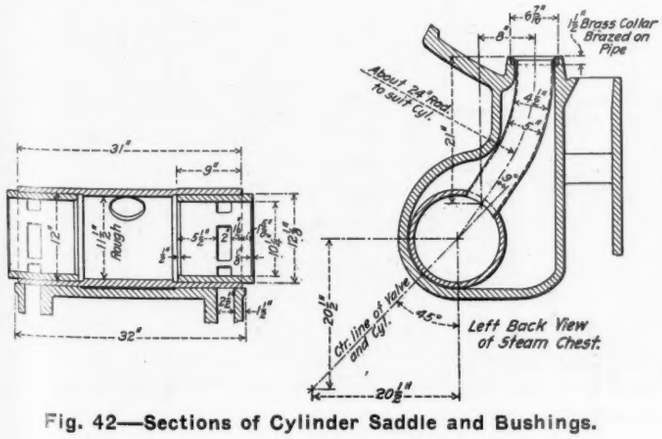


Fig. 42—Sections of Cylinder Saddle and Bushings.

The saddle casting shown is that of an inside admission valve, with two short valve bushings. When the crack occurs in the live steam passage between these bushings, the steam must be carried direct from the steam pipe to the valve chamber, thus relieving the cracked cylinder of all steam pressure. The short bushings are removed, the valve chamber rebored to receive a ⅞-in. thick bushing which extends over the outside edges of both steam ports. Steam ports are cut in this long bushing and the short bushings replaced. A 5-in. diameter hole is bored in tne long bushing, in which the 5-in. seamless steel tube is rolled with a specially made roll expander. The upper end of the tube has a ring brazed to it, which ring joints with the casting.

OLD MAN FOR BOILER WORK.

The old man shown, Fig. 43, illustrates a design made by C. H. Weeks, a gang foreman at Elizabethport. It is intended particularly for work on boilers, but is applicable in other cases. The base is made of boiler plate, 1½ in. x 10 in. x 10 in. A side elevation of this base plate would show that by cutting out the center portion of the vertical metal four feet are formed. This provides for clearing rivets, etc.

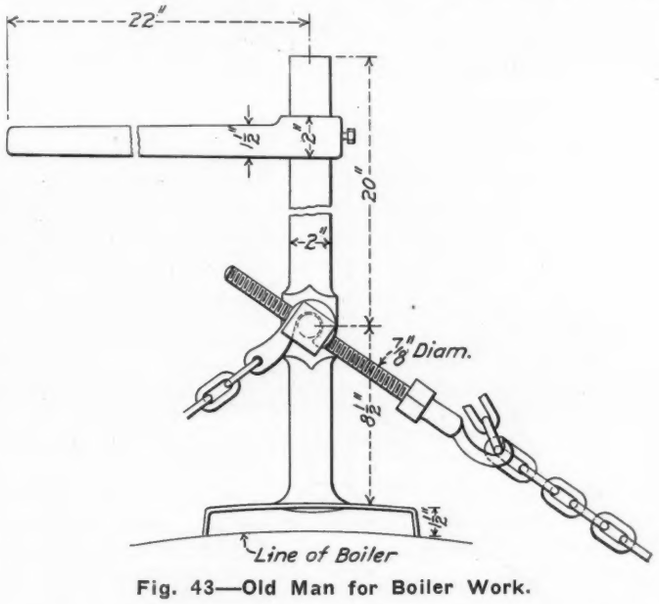


Fig. 43—Old Man for Boiler Work.

This old man is easily and quickly placed and by passing the chain around the boiler and catching a link in the hook the device is fastened tightly by the use of the threaded bolt which has a swivel connection with the hook.

SLOTTER TOOL.

The slotter tool shown in Fig. 44 was designed to save resetting, on the plate, of the tool when change of cut direction is made. It is also advantageous in that it allows the use of small pieces of high speed tool steel. The slot will take ½-in. steel, which is held in place by tightening the top nut.

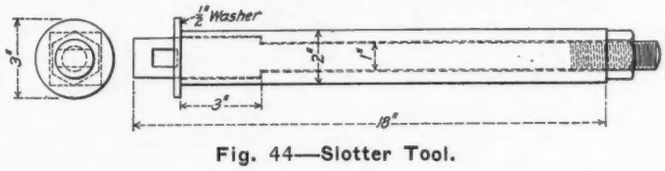
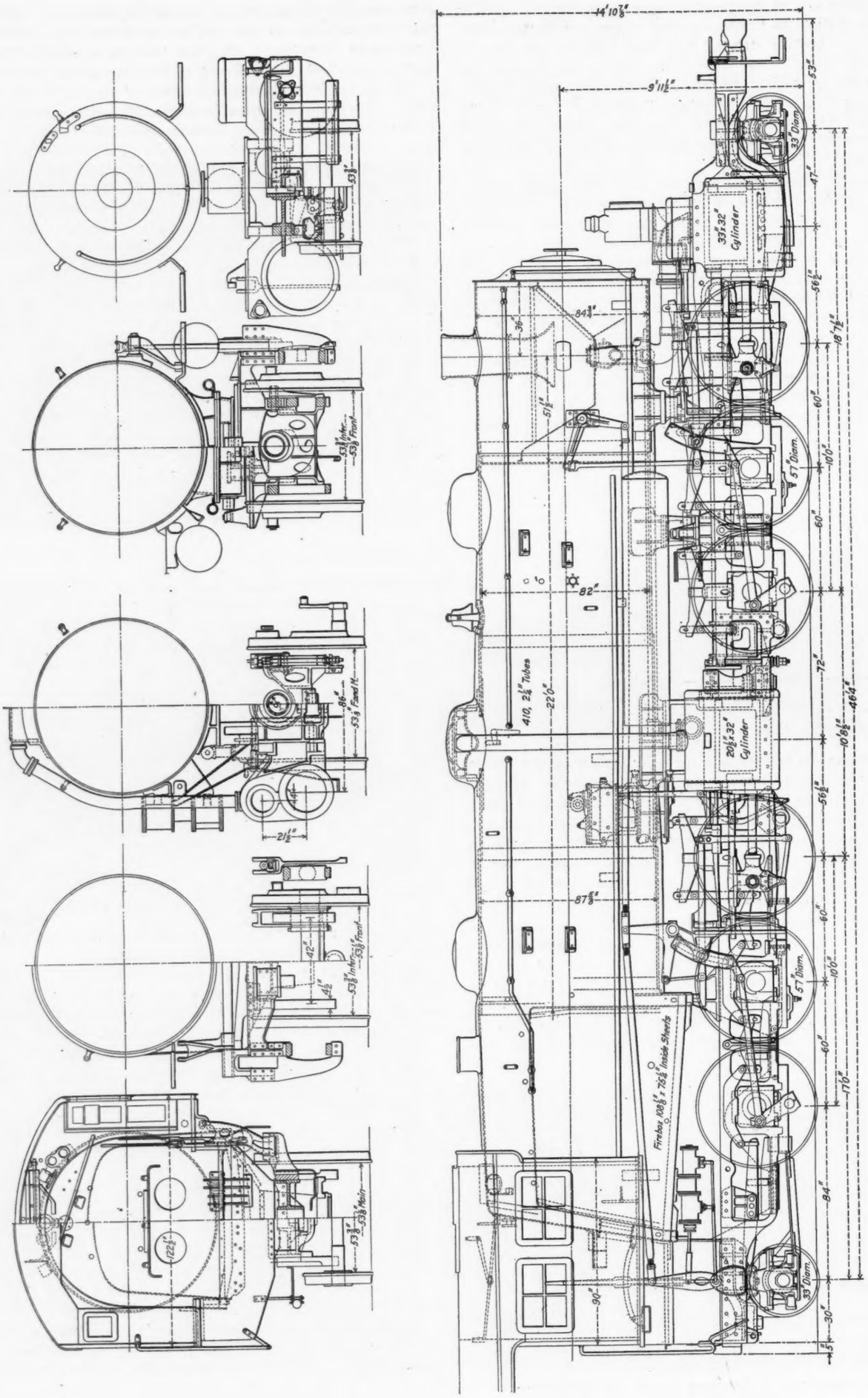


Fig. 44—Slotter Tool.

When it is necessary to change a slotter tool at the plate, in order to change direction, the exact stroke is very often lost. With this tool, the stroke is not altered at all and the cutter is easily and quickly adjusted to any position by loosening the nut at the top of the tool.

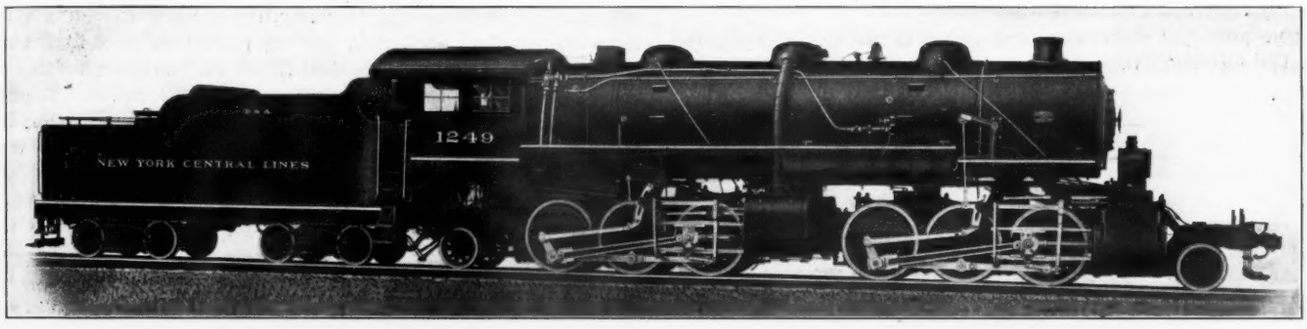


Mallet Compound Locomotive; Boston & Albany, New York Central Lines.

MALLET ARTICULATED COMPOUND LOCOMOTIVE. NEW YORK CENTRAL LINES.

The Boston & Albany Railroad of the New York Central Lines has recently received a Mallet articulated compound locomotive from the American Locomotive Company. It is the first engine of the articulated type to be put into service on the New York Central Lines, and will be used in hauling freight on the Albany and Springfield division. This part of the road passes through the Berkshire Hills and the grades are long and steep in both directions. Going east it is a practically continuous ascent from Rensselaer for a distance of about 43 miles, the maximum gradient in this distance being .87 per cent. For the next 9 miles there is a down grade into Pittsfield Junction. Then comes a grade 6 miles long of 1.42 per cent. to Hinsdale, the summit of the division. Westbound from Springfield the grades are equally heavy, the last 11.5 miles of the ascent between Chester and Washington having an average grade of 1.5 per cent.

At present the freight traffic is handled by consolidation locomotives having a total weight in working order of 234,000 lbs., cylinders 23 in. by 32 in., and a theoretical maximum tractive power of 45,700 lbs. Pusher engines are used on the two ruling grades both east and west. In order to handle the present maximum trainload over the division without helpers and to increase the weight of the trains, with a view to reducing the operating cost and increasing the efficiency of the division the officials of the New York Central Lines are considering the adoption of the Mallet type of locomotive; the engine illustrated was purchased for the purpose of determining the efficiency of this class of power for such service. Although it is thus in a sense an experimental locomotive the success of the Mallet type on other roads where the conditions are analogous to those existing on the Boston & Albany leaves little doubt but that it will mark the adoption of this type on that road.



First Mallet Compound Locomotive for the New York Central Lines.

The following table gives a comparison of the principal dimensions of the new locomotive, and the present class of heavy freight engine on the Boston & Albany:

Type of locomotive	2-8-0	2-6-6-2
Weight in working order.	234,000 lbs.	342,000 lbs.
" on drivers	208,700 "	296,500 "
" on leading truck..	25,300 "	23,500 "
" on trailing truck.	..... "	22,000 "
Diameter driving wheels..	63 in.	57 in.
Cylinders, diam & stroke.	23 in. x 32 in.	20½ & 33 x 32
Boiler pressure	200 lbs.	210 lbs.
Max. tractive power, comp	.....	66,600 lbs.
Do., simple	45,700 lbs.	80,800 lbs.
Driving wheel base(rigid)	17 ft. 6 in.	10 ft. 0 in.
Engine wheel base	26 " 5 "	46 " 4 "
Heating surface, tubes...	3,474.8 sq. ft.	5,291 sq. ft.
" " firebox .	185.6 "	185 "
" " w. tubes	28.7 "	..... "
" " total ..	3,689.1 "	5,476 "
Grate area	56.5 "	56.5 "
Average load per axle ...	52,175 lbs.	49,400 lbs.

It will be seen that the Mallet locomotive has about 45 per cent. more tractive power than the consolidation, while the average weight per axle is about 2,775 lbs. less, and the rigid wheel-base is 7 ft. 6 in. shorter. Another interesting fact is that the grate area of the two classes of engines is the same, which gives a much larger proportion of heating surface to grate area in the Mallet locomotive than has been the previous practice in locomotives of this type. Service tests of Mallet engines designed to burn bituminous coal have, however, proven that larger grate areas have hitherto been provided than were required for slow speed service. The grate area was, therefore, reduced, facilitating firing and securing a better rate of combustion.

Exhaustive dynamometer and efficiency tests are being made of this engine on the Pennsylvania division of the New York Central; we hope in a future issue to publish the results of these tests. With the exception of a larger boiler and larger truck wheels the locomotive is practically a duplicate in design of eight of the same type recently delivered by the builders to the Denver & Rio Grande Railway. As far as the features characteristic of the Mallet type of locomotive are concerned the design follows the builders usual practice. The wheel arrangement is of the 2-6-6-2 type, having a two-wheel truck front and rear. The theoretical maximum tractive power working compound is 66,000 lbs., which, with the Mellin system of compounding employed, can be increased to 80,800 lbs. by working the engine simple.

That a large boiler capacity has been provided is apparent from a study of the ratios. The figure of 693 for the B. D. factor is below the average for even simple engines designed for a similar class of service and would indicate that this engine would deliver its theoretical tractive power at the ordinary speeds of freight service. The boiler is of the straight top radial stayed type, and the barrel measures 82 in. in diameter inside at the front end. It contains 410 tubes 2¼ in,. in diameter and 22 ft. long. The total heating surface is 5,476 sq. ft., of which the tubes contribute 5,291 sq. ft. The ratio of the heating surface to the grate area of 97 is considerably higher than the usual practice for engines of this type, designed for burning bituminous coal. The crown and sides of the fire box are in one sheet, as are also the roof and sides of the outside shell. Ample water spaces are provided around the fire box, the mud-ring being 4½ in. wide on the side and back and 5 in. at the front. The fire box is supported at the rear end by a ⅝-in. buckle plate and at the front end by sliding shoes on a cast steel crosstie.

Cast steel frames are used and there is a single articulated connection between the frames of the front and rear systems. A strong and substantial system of frame bracing has been employed. In the front system the frame bracing consists of a heavy cast steel crosstie at the back end which is bolted to both the top and bottom rails of the frame, and to which the radius arm of the articulated connection between the front and rear frames is secured. A massive vertical steel casting located between the second and rear driving wheels extends down to the bottom rails of the frames, the upper part extending outside of the frames and furnishing a support for the self-adjusting sliding boiler bearing; another steel casting of similar design, located between the first and second pair of driving wheels, constitutes the guide yoke and also the support for a second boiler bearing; a cast steel front deck cast-

ing ahead of the cylinders also serves for the engine truck center pin guide.

In the rear system, in addition to the cast steel foot plate at the back end, the cylinder casting and the steel casting at the front end, which includes the bearing for the center pin of the articulated connection, is a heavy cast steel guide yoke across the upper rails of the frame between the first and second pair of driving wheels and the cast steel crosstie over the middle pedestal which furnishes the support for the front end of the fire box. The front and rear systems are equalized together in the usual manner by vertical bolts connecting the upper rail of the front frame with the lower rail of the rear frame. As in the engines of this type built for the Virginian Railway, the load on the bolts is supported by a coil spring through which the lower end of the bolt passes and which presses up against the bottom of the rear frame rail, thus giving the flexible support at this point which is necessary in order that the three boiler supports, viz.: the two sliding bearings and the equalizing bolt, may each bear its proportion of the load in any variation of the alignment of the three. Both the front and rear trucks are of the center bearing radial type with swinging bolster and similar in design to that of the Virginian Mallet engines. The bolster is suspended by three-point or stable equilibrium hangers. The truck frame is of cast steel and the portions of the sides over the journal boxes are shaped to form caps for the coil springs, which transmit the load to the journal boxes upon which they are directly seated.

The principal dimensions and ratios of the design are given in the following table:

Ratios.

$$\frac{\text{Weight on drivers}}{\text{Tractive effort}} = 4.45$$

$$\frac{\text{Total weight}}{\text{Tractive effort}} = 5.13$$

$$\frac{\text{Tractive effort x diameter drivers}}{\text{Heating surface}} = 693$$

$$\frac{\text{Total heating surface}}{\text{Grate area}} = 97$$

$$\frac{\text{Firebox heating surface}}{\text{Total heating surface}} = 3.37^{*}$$

$$\frac{\text{Weight on drivers}}{\text{Total heating surface}} = 54$$

$$\frac{\text{Total weight}}{\text{Total heating surface}} = 62$$

$$\text{Volume of equiv. simple cyldrs, cu.ft.} = 19.32$$

$$\frac{\text{Total heating surface}}{\text{Volume equiv. simple cylinders}} = 283$$

$$\frac{\text{Grate area}}{\text{Volume equiv. simple cylinders}} = 2.92$$

* Per cent.

General Data.

Service	Freight
Fuel	Bituminous Coal.
Tractive power, compound	66,600 lbs.
Tractive power, simple	80,800 lbs.
Weight on drivers in working order	296,500 "
Weight, total in working order	342,000 "
Weight of engine and tender in working order	494,700 "
Wheel base, driving, front engine	10 ft.
" " " rear engine	10 "
" " " total	30 ft. 8½ in.
" " front engine	18 " 7½ "
" " rear engine	17 ft.
" " total	46 ft. 4 in.
" " of engine and tender	74 " 8 "

Cylinders.

Type	Compound.
Diameter	20½ and 33 in.
Stroke	32 in.

Valves.

Type, high pressure	Piston
Type, low pressure	Double ported slide
Travel, high pressure	6 in.
Travel, low pressure	6⅛ "
Steam lap, high pressure	1⅛ "
Steam lap, low pressure	1 "
Exhaust lap, high pressure	¼-in.
Exhaust lap, low pressure	¼-in.

Wheels.

Driving, diameter	57 in.
Thickness of driving tires	3½ "
Driving axles—size of journals	9 x 13 "
Engine truck and trailing wheels, diameter	33 "
Engine truck and trailing axles, journals	6 x 12 "

Boiler.

Style	Straight top
Working pressure	210 lbs.
Firebox, length and width	108⅛ x 75¼ in.
Firebox, water spaces	F., 5 in.; S., 4½ in.; B., 4½ in.
Firebox sheets, thickness	Crown ⅜-in., tube ½-in., sides ⅜-in., back ⅜-in.
Crown staying	Radial
Tubes, number	410
Tubes, diameter and length	2¼ in. x 22 ft.
Heating surface, tubes	5,291 sq. ft.
Heating surface, firebox	185 "
Heating surface, total	5,476 "
Grate area	56.5 "
Smokestack, diameter	19⅛ in.
Smokestack, top above rail	14 ft. 10⅞ in.

Tender.

Tank, style	Water bottom
Tank, capacity, water	8,000 gals.
Tank, capacity, coal	12 tons
Frame	13 in. channels
Wheels, diameter	33-in.
Axles, size of journals	5½ x 10 in.

QUALIFICATIONS OF THE TRAVELING ENGINEER.

The peculiar variety of duties performed by the road foreman or traveling engineer requires the selection of a man in good physical condition, having considerable ability and good judgment along mechanical lines; furthermore, to obtain results and keep the several members of the railway family working in harmony, he must be somewhat of a diplomat, without being an all-around good fellow. For this reason the men advanced to the position of assistant road foreman of engines, or traveling engineer, should be first-class enginemen, having not less than two years' road experience, and before being promoted should have had a certain amount of experience on special work in the master mechanic's department, relative to shop conditions, also grates, draft appliances and the use of steam indicators, or at least how to intelligently read indicator diagrams as to cause and remedy for certain conditions of valves and cylinders, thereby broadening their views and better fitting them to analyze mechanical problems from both a shop and road standpoint. The superintendent and master mechanic should keep in training a limited number of available men who would be in line for advancement to such positions of responsibility.

This suggestion might also include the instructor of firemen, where this position is required. The instructor of firemen is necessarily a much younger man and should not be considered in direct line for further promotion without having experience as an engineman in road service; however, to have desirable men always available for this position, firemen, under certain regulations, should be permitted to make application and be given shop experience as machinist helper, or inspector, under the direction of the foreman in charge. This suggestion is made advisably, knowing well the probable adverse criticism that such an arrangement would badly affect shop organization, on account of the frequent change in men and the probable increased rates paid enginemen or firemen while so employed. Such comments are to some extent warranted, especially in case of a reduction of force in both enginehouse and road forces, where the regular shop employees might have to give way to the road men. On the other hand, shop hands could be considered eligible for promotion to the position of firemen, but this is also open to the objection before mentioned. However, if at all practicable, such an arrangement would be of great benefit along educational lines and tend toward a higher efficiency of the entire force.—*J. R. Alexander*, general road foreman of engines, Pennsylvania Railroad, before the Railway Club of Pittsburgh.

THE USE OF STEEL IN LOCOMOTIVE AND CAR CONSTRUCTION.

D. F. Crawford, general superintendent of motive power of the Pennsylvania Lines West of Pittsburgh, has prepared a most valuable and exhaustive report on the "Use of Steel in the Construction of Locomotives and Rolling Stock in America"* for discussion at the eighth session of the International Railway Congress. His endeavor has been to give the results obtained by the use of steel or partial steel construction from a general operating and maintenance standpoint, rather than from the purely technical or designer's point of view. We regret that space does not admit of reproducing the entire report; the following extracts cover some of the more important points:

LOCOMOTIVES.

Fireboxes.—Steel fireboxes last from three to twelve years, depending somewhat on the nature of the service in which the locomotive is used and the quality of the water available in the district, as well as the design of the boiler and firebox. In general, the life obtained from the wide fireboxes used on many locomotives at the present time, is not as long as that obtained from the narrow fireboxes previously in general use. The average life of fireboxes obtained in two groups of locomotives coming under the writer's observation is as follows:

Firebox 40 in. wide, average life.....	85 months.
Firebox 66 in. wide, average life.....	57 months.

The causes assigned for this difference have been as follows: With the wider fireboxes, the fire is thin immediately adjacent to the side sheets, causing rapid variation in the temperature at the side sheets. The straight sides of the wider fireboxes do not present the same opportunity for expansion and contraction as the curved sheets used in the narrow construction. The circulation of water is more favorable with the curved sheets.

Tubes.—Steel tubes have not been in use a sufficient length of time to determine whether they will eventually entirely supplant the wrought iron tube, but the large increase in their use by many roads would indicate favorable results. The lower cost of the steel tube, as compared with the wrought iron tube, led to their trial and the results obtained seemed to warrant their further consideration. The success obtained with the steel tube will undoubtedly depend somewhat on the quality of the water used, as, up to the present time, it would appear that with water containing corrosive materials the steel tube is affected by corrosion more rapidly than the iron tubes.

An interesting use of the seamless steel tube is for safe ending wrought iron tubes with steel. On one road operating about eighteen hundred locomotives, it has been the practice to use seamless steel tubing for safe ends for several years, for the following reasons:

1. Steel ends stand up better under the repeated calking and beading required, thus the time between resetting of tubes is prolonged.
2. Reduction in cost of material as compared with charcoal iron and reduced maintenance cost on account of prolonged life of the tubes.
3. The life of the wrought iron tubes already in service was prolonged, as safe ending is less frequent.
4. Less length of the steel tube subject to corrosion as compared with the entire steel tube.

Axles.—From both a strength and service standpoint, the carbon steel axle may be considered satisfactory, but with the larger sizes precaution is necessary to obtain solid billets, and in some cases it is the practice to bore a hole about two inches in diameter from end to end in the center of the axles of the larger sizes to permit of interior inspection.

Springs.—With the heavier loads now carried by the springs, some difficulty has been experienced in obtaining satisfactory service, and the chemistry of spring steel, as well as the heat treatment and method of manufacture, is receiving the attention of the railway mechanical engineers and the spring manufacturers. Springs made of steel containing vanadium are being used experimentally, and laboratory tests of the material are at least promising, although the service tests have not been of sufficient duration to permit conclusions being drawn.

Steel Castings.—With the advent of heavier locomotives, the desirability of obtaining material of greater strength than cast iron led to the adoption and almost general use of steel castings in place of cast iron for the following locomotive parts: Driving wheel centers, driving boxes and truck boxes, eccentrics, eccentric straps, frame braces, pistons (centers), as well as many of the other castings used. The development of the manufacture of steel castings for the above mentioned purposes permitted their manufacture at a cost which made their use attractive as a substitute for many of the parts which had been made of wrought iron, and many locomotives have been built having the parts named below made of steel castings instead of wrought iron: Frames, spring rigging, stirrups, saddles, hangers and equalizers, valve motion parts, guides and guide yokes, cross heads and many of the smaller forgings.

Conclusions.—In locomotive construction steel has been substituted for other materials for the following reasons:

1. Greater strength, permitting use of relatively smaller and lighter parts.
2. Stronger material necessary to meet the demand made by the more powerful and consequently heavier locomotives constructed at the present time.
3. Lower first cost and reduced maintenance cost as compared with the other materials if used on the present heavy locomotives.

For three reasons the use of steel, without doubt, will be extended to include practically all parts of the locomotives, other than certain of the wearing surfaces which will be of bronze or of other bearing metal or of cast iron.

FREIGHT CARS.

Number of Steel and Steel Underframe Cars.—In twelve years there have been built by the larger car manufacturing companies approximately 311,000 all steel and 242,000 steel underframe cars, divided in kinds as follows:

All Steel.

Box	18
Gondolas, hoppers, dump, ore and coke	299,425
Tank	7,250
Flat, log and miscellaneous	4,375
Total	311,068

Steel Underframe.

Box	125,403
Refrigerator	1,821
Stock and coke	16,797
Gondolas, hoppers, ballast, ore and dump	75,463
Flat	21,139
Miscellaneous	1,214
Total	241,837

To these numbers must be added the cars built by the smaller companies, as well as those built by the various railway companies at their own shops. It is estimated, from the data available, that there are in use on American railways, a little over a half-million steel and steel underframe cars, or about 20 to 22 per cent. of the freight carrying cars in use.

Cost of Cars.—It is impossible to give any accurate comparison of the first cost of cars of steel and cars of wooden construction as any steel cars which have been built are of much stronger design and construction than the wooden ones. That is, the cost of exactly equivalent strength is not available. Therefore, part of the higher cost of the steel car is due to increased strength rather than to the change of material. The fluctuation in the price of material also makes variations. It is safe to assume that cars of all steel construction will cost from 25 to 50 per cent. in excess of cars of

*Bulletin of the International Railway Congress Association, Vol. XXIV., No. 2, page 527, February, 1910.

wooden construction, depending on the difference in the strength of construction permitted. As the available supply of lumber decreases, the cost is increased and even at this date the grade or quality of lumber formerly used in car construction is sold at a price which makes it necessary to lower the grade of lumber used, the cost of the grade which is considered best prohibiting its use. The difference in price of the steel as compared with the wooden cars will undoubtedly become more favorable to the former, both on account of the increased cost of lumber and the possible decrease in the price of steel, made possible by the rapid developments of the various manufacturing processes involved.

Cost of Maintenance.—On the Bessemer and Lake Erie Railroad, where steel cars have been in use since 1897, records have been maintained to ascertain the average cost of maintenance for wooden and steel cars separately. From the annual report of this company your reporter quotes the following:

Average maintenance cost per car per year.

Year.	Wooden cars.	Steel cars.
1905	$71.14	$27.83
1906	94.11	30.74
1907	118.50	39.21
1908	53.06	32.11

The steel cars covered by the above are of the all steel construction. This data is the best available on the comparative cost of maintenance of cars of wooden and of steel construction at the present time, as on many roads separate records of costs of the steel and wooden cars have not been maintained, and on other roads the cars of steel construction have not been in service a sufficient length of time to permit the consideration, as comparative, of such data as has been obtained. The writer's observations and estimates tend to confirm the figures given above, namely. That the all steel cars can be maintained for about $30 per car per year as compared with $60 per car per year for cars of wooden construction.

Life of Steel Cars.—Twelve years is, of course, not a sufficient length of time to obtain any data regarding the probable life of the steel cars or steel parts of the composite cars. Careful inspection of a hopper car used for carrying coal and ore for eleven years fails to give any evidence as to what life may be expected, the deterioration being hardly appreciable. The cars of wooden construction were frequently damaged in service to such an extent that the expense of restoring them to condition for service was not warranted. With the cars of steel construction very few cars have been damaged to the extent which would make it inadvisable to repair them. Of the cars of steel and steel underframe construction in the freight carrying equipment of the Pennsylvania Railroad but 18 of all steel cars and 126 of the steel underframe cars have been destroyed in eleven years, the majority of these being destroyed on other roads where facilities for repairing had not been provided; during the same period about 20,000 wooden cars were destroyed as a result of being damaged in service.

Weight and Capacity.—Comparisons of the weight carrying capacity and the cubic capacity of cars of steel construction or having steel underframes, and the same points of cars of wooden construction, with the weight of the vehicle, show considerable advantage in the use of the steel structures. By the use of cars of larger capacity, the proportion of the paying load to the total weight of lading and car is generally increased, and the effect of the use of the heavier cars in service during a term of years on a portion of the Pennsylvania Railroad system shows an increase of 67.5 per cent. in the average paying load per car in the year 1907, when the maximum service was being rendered by the railways in America, over the average paying load per car in 1890. While the average paying load per car increased 67.5 per cent. the average weight of the vehicles used in 1907 increased by but 47.5 per cent. as compared with those used in 1890.

Service Comparisons.—It has been found that with the larger capacity cars in use in 1907, a given locomotive could haul about 60 per cent. more paying load than it could have hauled in the cars of lower capacity in use in 1890. This statement refers to the average weight and the average lading of cars and, of course, covers all kinds of commodities carried, many of which tax the cubic capacity rather than the weight carrying capacity.

An example is given showing that a certain locomotive would haul in the cars of steel construction 16 per cent. more paying load than it would in the cars of wooden construction, and to move the traffic there would be required twenty-one less cars, of which the first cost, interest and maintenance charges must be considered. In addition to withstanding the wear and tear incident to the operation on unloading machines better than the wooden cars, the cars of steel construction, on account of their greater carrying capacity, permit the unloading of 1,500 tons of coal per hour, instead of 900 tons per hour as would be the case with cars of wooden construction.

Wheels.—Solid forged steel wheels are produced for about one-half the cost of a steel tired wheel of the same diameter and general dimensions and the net cost is about three times the net cost of the chilled cast iron wheels. Net cost is the difference between the cost of the wheel when new and the amount obtained for the worn out wheel when removed from service. At the present relative prices of the solid steel wheels and the cast iron wheels, with proper allowance for salvage in each case, the indication from service tests is that the cost per mile of the steel wheel will compare favorably with the cost of the cast iron wheel per mile, allowance being made for interest on the increased investment involved in the use of the steel wheel. From the evidence so far obtained, it will be possible to obtain solid steel wheels of much greater strength than the wheels made of cast iron for about the same service cost, and improvements may be expected to make the comparison still more favorable to the steel wheel. From tests made by Geo. L. Fowler it was found that the flange of a cast iron wheel could be broken off by an applied pressure of from 60,000 to 110,000 lbs., while to break off the flange of a steel wheel required the application of 526,612 lbs. pressure. In service some trouble has been experienced with the solid wheels on account of lamination of the metal in the treads similar to the lamination which sometimes occurs in steel tires. Improvement in shop methods and larger experience in manufacturing, however, have reduced the percentage of wheels showing evidence of lamination and further experience will, no doubt, practically eliminate the defect.

It is desirable to increase the nominal capacity of cars having the steel wheels from 100,000 lbs. to 110,000 lbs. for two reasons:

1. The increase in the paying load at least makes up for the higher charge for interest necessary on account of the larger investment.

2. It tends to prevent the use of cast iron wheels under such cars, as the steel wheels are a necessary part of the higher capacity cars.

Conclusions.—From examination of the designs and construction of the freight carrying cars recently built and building for the railways in America, your reporter draws the following conclusions:

1. Cars of steel construction or with steel underframes will be substituted for cars of wooden construction.

2. Steel will be used more extensively for that portion of the car now made of wood; that is, the side framing, end framing and roof carlines and similar parts will be of steel.

3. Steel castings and pressed steel and structural steel shapes will be substituted for parts now made of cast or wrought iron.

4. The manufacture of steel wheels has made sufficient progress to permit of their consideration for the high capacity cars.

5. The use of steel in freight car construction has permitted the development of cars of maximum capacity and minimum weight consistent with strength.

6. Cars of the greater capacity permissible with the steel construction facilitate the movement of traffic in many ways and assist in obtaining economical maintenance and operation.

PASSENGER CARS.

Number of All-Steel and Steel Underframe Cars.—Several of the railways in America have in service passenger train cars, and others are building or have under consideration at the present time the design of passenger train cars of all-steel or steel underframe construction. Information obtained from the various car builders shows they have built to date for steam railway service the following number of passenger train cars in which metal is extensively used:

Steel underframe cars	400
All-steel cars	900

The Pennsylvania Railroad System have had built, or have under construction, passenger train cars of all steel construction as follows:

Passenger cars	392
Combined passenger and baggage cars	75
Dining cars	44
Postal or mail cars	82
Baggage and mail storage cars	93
Total	686

The Pullman Company, which operates the majority of the sleeping cars in service on the railways in America, has under construction, a large number of sleeping cars of all steel construction.

Design.—The designs prepared to the present time may be divided into three classes, viz.:

1. That in which the load due to the weight of the car body and lading is carried by the center girder which at the same time takes care of the pulling and buffing strains.

2. That in which the load due to weight of the car body and lading is carried by the side girders; an additional girder being provided at the center of the car for the pulling and buffing strains.

3. That in which the center and side sills with truss rods used in the wooden car construction is reproduced in metal.

While the majority of the cars built have been of the first class described, several of the later designs are of the second class. Very few cars of the design covered by the third class have been built, and it does not seem likely that this type will be extensively used, as it does not permit of the best utilization of the possibilites in metal construction. From a study of these designs it is found:

A.—For stresses other than pulling and buffing, cars of equal strength will be practically the same weight and cost for structure.

B.—Where pulling and buffing strains do not exceed 100,000 lbs. the weight and cost of the structure will still be practically the same.

C.—To resist pulling and buffing strains exceeding 100,000 lbs. the weight of the car in which the sides carry the load will be increased, while the weight of the car of the first type would not be increased for strains within a limit of 400,000 lbs.

D.—Cars of the third type mentioned to have equal strength of the other types will weigh more.

It having been the practice to assume for freight cars that the car must be capable of withstanding shocks of 300,000 lbs. compression, whenever the car is shifted, and that such shocks very often are equivalent to 500,000 lbs., such cars were given a center sill construction capable of resisting such shocks without exceeding the elastic limit of the metal. Experience with freight cars in the past five years indicates that this basis is none too high. From tests made by allowing a dynamometer car weighing 51,000 lbs. to run down a grade at seven miles per hour and collide with a train of loaded cars having the brakes set, a shock of 607,000 lbs. (the capacity of the dynamometer) was recorded. A loaded steel freight car and the dynamometer car, weight 181,400 lbs., striking the train referred to above, at three and nine-tenths miles per hour, caused a shock of 400,000 lbs. As cars in steam railway service come together and are coupled at speeds equal to or in excess of those mentioned, it could not be considered safe to assume shocks less than 300,000 or 400,000 lbs. In collisions between passenger and freight cars the passenger cars should not be seriously damaged, which would require the passenger car center sill construction to be at least as strong as the same parts of the freight car.

For passenger cars a higher factor of safety is desirable, therefore, the design of the center sill construction is based on end shocks equivalent to 400,000 lbs. compression, under which the combined stresses should be about 12,500 lbs. per square inch and in no case exceed 15,000 lbs. per square inch for cars used in heavy trains in through service, and not more than 20,000 lbs. per square inch for cars used exclusively in suburban service. The stresses in the framing throughout under static load do not exceed the usual practice of 12,500 lbs. per square inch and none of the superstructure above the belt rail has been included in determining these stresses.

Cost of Cars.—Comparison of the cost of cars of wooden construction 70 ft. long between end sills and cars of steel construction of the same length, the cars to be alike in seating capacity, and all details such as couplers, air brakes, vestibules, toilet facilities and electric lighting system, would indicate that at the present time the car of all-steel construction will cost from 16 to 25 per cent. in excess of the car of wooden construction. As the price of lumber suitable for the construction of passenger cars continues to increase and as the number of parts made of metal and the weight of the metal parts is increased in the desire to obtain greater strength there is no doubt but that the cost of cars of wooden construction will be higher than at present, while with the cars of steel construction it is to be expected that the cost will decrease due to the simplification and standardization of the designs, improved manufacturing methods developed by experience and the development of special machinery for producing various parts which are now made with ordinary machinery or by hand.

Cost of Maintenance.—As a considerable proportion of the cost of maintaining passenger equipment cars is due to the frequent painting and renovation of the interior fittings, the maintenance cost, while less with the cars of metal construction than that of cars of wooden construction, will not be as great as that between the cost of maintaining freight cars of metal and wooden construction. The cost of running repairs, other than wheels, will be reduced on account of the large reduction in the number of bolts, the nuts of which must be kept tight, and there will be no shrinkage of parts which loosens the structure sufficiently to cause racking and requiring fastenings to be drawn up frequently.

Weight and Capacity.—From the designs made for passenger carrying cars it has been ascertained that cars of all-steel construction having from three to four times the strength of cars of wooden construction of the same general type, may be built without undue increase in weight of the car as compared with that of the car of wooden construction.

It is estimated that the weight of the Pullman sleeping car of all-steel construction will be from 145,000 to 150,000 lbs., while a similar car of wooden construction weighs from 125,000 to 130,000 lbs. Although cars of steel construction are somewhat heavier than similar cars of wooden construction it must be remembered that in designing the all-steel car advantage was taken of the opportunity to provide a stronger car.

From special records made on a large number of trains of

the number of passengers carried it was determined that the actual average weight per passenger of these two classes of cars in service during periods of normal traffic:

Wood	1,783 pounds per passenger.
Steel	1,835 pounds per passenger.

and during periods of abnormal, such as holiday traffic:

Wood	1,675 pounds per passenger.
Steel.	1,637 pounds per passenger.

Conclusions.—From examination of the designs and construction of the passenger carrying and passenger train cars recently built, and building for the railways in America, your reporter draws the following conclusions:

1. Cars of steel construction will be substituted for cars of wooden construction on account of the former having greater strength, being non-inflammable and less expensive to maintain.

2. The difference in weight of the cars of metal and the cars of wood is not such as would make their use prohibitive from an operating standpoint.

3. As the cost of the cars of steel construction will probably decrease, due to more experience in their design and construction, the cost of cars of wooden construction will undoubtedly increase, due to the scarcity of suitable materials and the use of the metal cars will be extended.

4. For railways using electricity as a motive power the danger of serious accidents will be reduced by the use of the metal cars.

5. The metal structure will better retain its initial strength than any composite structure made up of wood and metal, such as the cars of the so-called wooden construction in use to-day.

GENERAL CONCLUSIONS.

1. The present practice in America in the construction and designing of locomotives, freight cars and passenger cars is to use steel either of rolled or pressed shapes, or steel castings for many parts, extending to practically the complete car.

2. The progress made in design and manufacture in steel of the various details of locomotives and cars, such as tubes, wheels, bolsters, truck frames and similar parts, indicates that further substitution of this material for wood, wrought and cast iron may be expected.

3. While steels of special alloy or composition have been utilized in the building of railway rolling equipment, neither the quantity used nor the length of time in service is sufficient to warrant any expression as to the possible economy to be obtained by their use.

4. The use of steel construction of railway rolling equipment has generally given advantageous results, both from a service and economic standpoint, as compared with the results obtained with the material for which it was substituted.

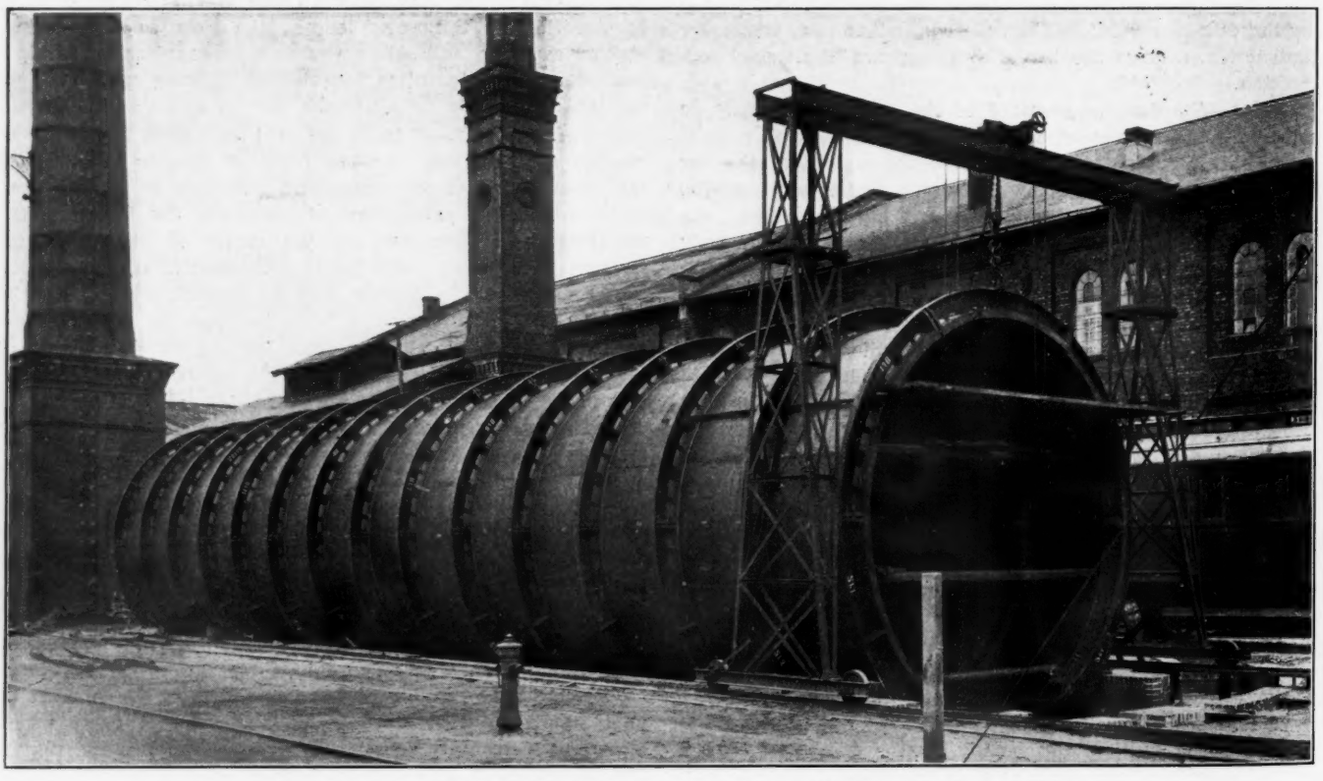
THE DISINFECTING OF PASSENGER COACHES.*

BY P. SCHUMACHER.

The regulations to prevent danger from infection and contagious diseases in railway traffic in Germany cover the following points:

1. General provisions.
2. Measures to be taken in railway traffic whenever diseases dangerous to the public make their appearance.
3. Treatment of railway cars when diseases of the above description break out.
4. Directions for disinfection.

International traffic, and more particularly the traffic with Russia, made it an urgent necessity to construct a device in which any vermin infecting the cars could be absolutely destroyed. Furthermore, an enclosed space which can be quickly heated to high temperatures, and in which such temperatures can be maintained for a considerable length of time, is an exceedingly desirable addition to the equipment of passenger-car shops. The floors of dining and kitchen cars are frequently found to be wet through. Slight damage to car roofs is often the cause of wet ceilings, and, furthermore, the hot-water heating devices in parlor and sleeping cars are not always tight and sometimes drench the double floors. In very cold weather damage to the hot-water heat-



Apparatus for Disinfecting Passenger Coaches, with Front Head Removed.

*From *Annalen fur Gemerbe und Bauwesen*, Berlin, Jan. 15, 1910.
†Works Manager, Royal Prussian State Railways, Potsdam.

ing plants in sleeping and parlor cars, due to freezing, is unfortunately of frequent occurrence, and the consequences resulting from such damage could heretofore only be removed very slowly because it was necessary to let a car stand for days in the hottest part of the paint shop to heat it. In addition, it is very desirable for a railway shop to have an available drying room designed to quickly dry all kinds of articles, such as upholstered chairs that have been washed, as well as for thoroughly drying lumber and other purposes.

The Central shops in Potsdam have been used principally for several years past for the maintenance of parlor, sleeping and vestibule cars. Among these, those cars used for the Russian traffic are most frequently infested with vermin, and such cars could only be thoroughly cleaned by removing all the upholstered parts, and also the wainscoting. This method of cleaning is not only very expensive, but it involves considerable loss of time, inasmuch as the cars must remain in the shops for weeks. Furthermore, there is always danger of vermin escaping into the shops and subsequently infesting other cars.

The preliminary examination into the problem of constructing a device which would meet all the conditions demanded by the regulations and be serviceable in the above-mentioned cases of damage, etc., was commenced several years ago. From the beginning it was considered a primary requirement that the device should be designed for treating an entire car at one operation, and not merely parts of a car.

Devices supplied by the Julius Pintsch Company are known to have proved efficient in disinfecting ocean vessels at Hamburg, and that concern is likewise engaged in constructing large vacuum devices for various purposes. Extensive experiments have proven, for instance, that bed bugs can only be radically destroyed by heating all the parts (in the case now under consideration the entire car body is heated to a temperature of from 104° to 122° F.) and subsequently reducing the air pressure within the device for quite a length of time. This process can readily be used at the same time for thoroughly disinfecting the car in every respect.

Interior View of Apparatus for Disinfecting Passenger Coaches; Sleeping Car About to Enter.

The introduction of formalin has made disinfection considerably more perfect, but there were no available devices by which the formalin vapors could be made to penetrate to any great depth into recesses. The Julius Pintsch Co. thereupon worked out a plan for the construction of a device which has recently been completed and is now in practical operation.

OPERATION.

The car requiring treatment is pushed into the apparatus, which is heated by a system of pipes, until an even temperature of from 114° to 122° F. is obtained throughout the

interior. As soon as the cushions and other upholstered parts of the car have attained this temperature the air is pumped out by a special air pump plant, until the air pressure is reduced to from 27 to 29 inches of mercury below normal and without interrupting the heating process. It is known that water will boil under this air pressure at a temperature of 104° F. All such insects or other living organisms as may be present in the car are deprived of every particle of moisture and consequently must certainly perish. The above-mentioned preliminary experiments proved that bed bugs could not be absolutely destroyed by either heat alone or by the production of a vacuum, but that their absolute destruction can be insured by using these two factors in combination.

By this process, which has been patented by the Julius Pintsch Company, vermin and nits can be destroyed without taking apart or removing the car cushions, leather fittings, wooden frames, wainscotings, etc., and without any danger of damaging the various parts of the car, including the outside varnish and interior polish. If the car is also to be subjected to disinfection according to the reguations, formalin is introduced when the vacuum is at its lowest point, and is quickly evaporated. The formalin vapor will thus fill the entire space, and its action is not impaired by the air which remains in the device. If at the end of the operation the outer air is admitted, it becomes saturated with formalin vapor and conveys it into the most minute orifices.

CONSTRUCTION.

The cylindrical cross section of the device is exceedingly well adapted to the outlines of railway cars, inasmuch as it leaves sufficient space at the sides and bottom for installing heating devices, etc. The cylinder, both ends of which can be closed by means of heads, is made of cast-iron. It measures about 16 ft. 5 in. in diameter inside, while the available length for a car, measured from buffer to buffer, is about 75 ft. 6 in.

The device, which thus has the shape of a horizontal boiler, is composed of 15 cast-iron annular supports, which carry 14 cast-iron barrel sections, made up of separate plates. The barrel sections, as well as the annular supports, are so strongly constructed that there is no danger of the device being bent out of shape, either from its own weight, by the weight of a 60-ton car, or by the air pressure, even when there is a complete vacuum in the cylinder.

In designing the apparatus, a pressure of 3,129 lbs. per sq. in. and a tensile strain of 1,565 lbs. per sq. in were used as a basis. The total weight of the device, including the crane, is 297,000 lbs. The load supported by either of the 15 annular supports is 18,900 lbs. when the device is empty. When in this condition the surface pressure between the bed supports and the masonry work is 19.9 lbs. per sq. in., while the pressure amounts to 35.5 lbs. per sq. in. at the points of maximum strain, when the cylinder contains a car weighing 132,000 lbs.

The supports are equipped with rollers capable of moving in the longitudinal axis to provide for the longitudinal expansion of the device when it is heated. Actual measurements have shown this expansion to be about .78 in. at a temperature of 167° F. The track inside the cylinder has its bearings on the annular supports, vertically above the bed supports, and is fastened to the former. The base supports are thus made to bear the load of a car without exerting a strain on the other parts of the barrel. The fact that the supports are comparatively far apart made it necessary to use rails measuring 8.64 in. in height, so as not to exceed a bending strain of 2,640 lbs. on the rails.

The space between the rails is filled in with a runway of iron grating. Stop blocks have been provided for shutting off the rear end of the track, but as an additional safeguard against damage to the rear head a buffer has also been installed. There is a pit at the front end of the barrel to make room for the front head which closes the entrance opening and can be swung to one side. When the head is moved aside the pit is bridged over by sections of rail resting on swinging brackets, so as to make them easier to handle. This front head, or cover, is provided with steps and a foot-board, weighs about 8,800 lbs., and is forced against the rim of the barrel by tap bolts. The closure is made tight by an Indian rubber ring mounted in a groove and protruding slightly. Both the front and rear heads are composed of cast-steel frame collars of specially designed cross section and of a mild steel plate, convex on the inside, partly welded and partly riveted, and shaped like a segment of a sphere.

A movable crane of special design was required for the front head. This peculiarly constructed swinging crane is remarkable for the ease and convenience of its operation. The head or cover can be quickly and safely withdrawn and replaced by one man.

The device is heated by live steam, which is admitted through a main pipe running longitudinally through the upper part of the barrel. Two hundred and fifty-two semi-annular pipes form the connections between this main pipe and a joint condensing pipe which runs along the bottom of the cylinder. The condensed water is automatically drawn off by a steam trap placed outside of the cylinder. The so-called "Schneidendichtung" (edge packing) was selected for making the pipe joints tight. It was tested at a pressure of 213 lbs. per sq. in. above the atmospheric pressure and found to be absolutely tight. The pipe system is 6,429 ft. in length and provides a total heating surface of 2,260 sq. ft. Two fans, which operate in opposite direction, have been mounted in the center of the barrel, one on each side, to reduce the time required for uniformly heating all the air in the cylinder.

An evaporator for disinfecting formalin has been placed on the bottom of the cylinder, midway between the ends. Briefly described, it is an open vessel with a double bottom. Steam is admitted to the space provided by this double bottom and used for evaporating the formalin. While the apparatus is in operation the evaporator is filled from the outside; the formalin evaporates in an exceedingly short space of time in the rarified air of the cylinder. All the fittings required for operating the formalin evaporator are accessible from the outside.

A special inspection hole has been provided for reading the thermometers inside the cylinder. The thermometer scales are lighted up by electricity; one of the thermometers is freely suspended in space, while the other is immerged in a vessel filled with water. This arrangement provides not only a means for determining the maximum temperature of the atmosphere in the apparatus, inasmuch as it influences the varnish of the cars, but the thermometer submerged in water makes it possible to estimate the temperatures inside the cushions and other upholstered parts. In order to provide a convenient means for moving around in the apparatus while it contains a car, foot-boards have been mounted on both sides of the barrel, which are adequately lighted by 12 incandescent lamps. The cubic capacity of the apparatus is about 1,700 cu. ft.

THE VACUUM DEVICE.

A Siemens-Schuckert air pump, direct coupled to a 20 h. p. three-phase motor is installed in a small wooden extension of the railway shops. It is capable of producing a vacuum in the cylinder within two hours. The air in the cylinder is expelled through a pipe leading to the boiler room, where it may be discharged either under the grate of a steam boiler or direct into the chimney. When cars under suspicion of containing germs of any epidemic disease are being disinfected, such germs as may be carried along by the air are burned.

RESULTS OBTAINED.

On startng the operation of the plant it was found that the interior space could be heated to 212° F., when the outside temperature was 60° F. A normal temperature, up to 122° F. can be obtained within an hour, but the car placed in the apparatus will only be thoroughly heated at the end of about 5 hours. As above stated, the air can be sufficiently rarified within 2 hours. No damage to the varnished and polished parts of cars has been observed. Disinfection with formalin proved to be a very quick process, as the fluid evaporates instantly. The time during which the cars must be left exposed to the formalin vapor can only be determined by a series of experiments.

The first test was made with a car infested with bed bugs and was wholly successful. The bed bugs, as well as the nits, having their nests behind the mouldings and in crevices were thoroughly destroyed. Live bed bugs and the nits purchased from a vermin destroyer of Berlin and placed in the apparatus in a glass vessel, were likewise killed. This glass vessel was covered with cotton and closed with a linen cloth tied around the neck.

Several vestibule cars and dining cars have been treated for quickly drying the ceilings, walls and floors, which had become wet through. After heating the cars and leaving them in the vacuum, surprisingly satisfactory results were obtained at the end of 24 hours. The disagreeable kitchen smell in the dining cars had entirely disappeared. In such cases the cars are not treated with formalin.

By way of experiment, unseasoned lumber of various kinds, recently supplied, was also dried. The time allowed for this process should not be made too short, as the lumber is liable to crack. The time required for the process depends on the amount of moisture in the timber.

The plant was completed and its operation started in the fall of 1909. The approximate cost of construction was $18,800.

The operating expenses for disinfecting a large sleeping or vestibule train car are approximately as follows:

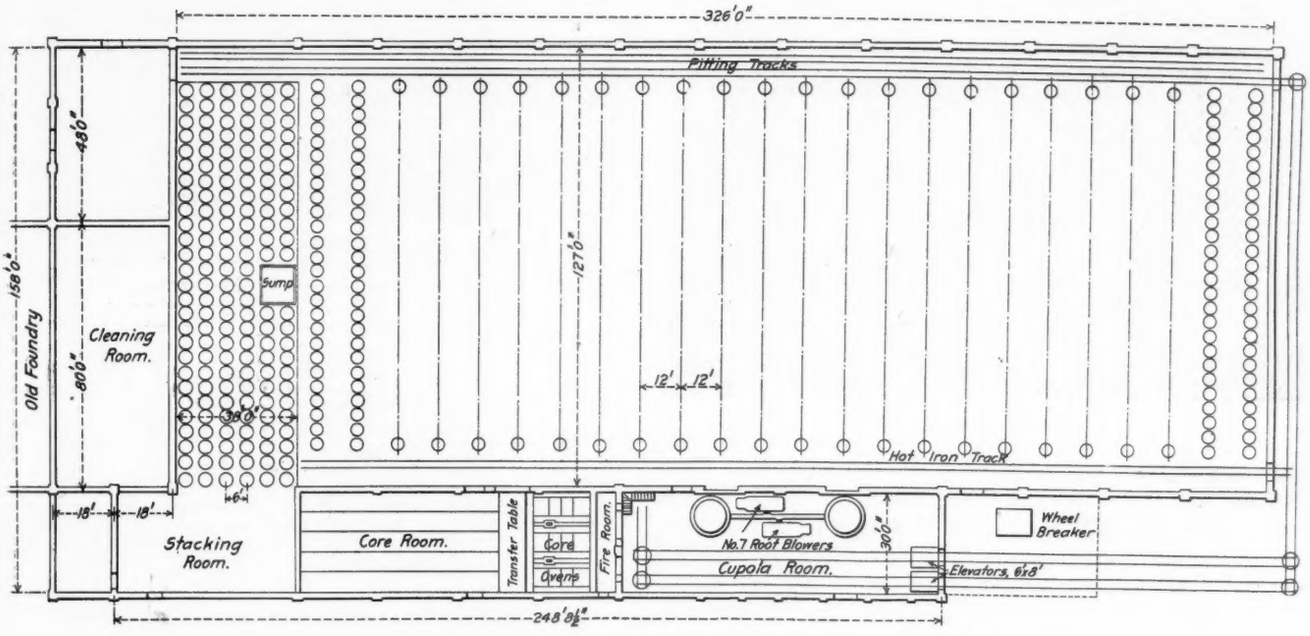
If heated during 10 hours, 1,100 lbs. of coal and water	$1.90
40 kilowatt-hours electric current for power and lighting	.95
11 lbs. formalin	1.07
Pushing car in and out of the apparatus, including expense of attendance	.84
Total	$4.76

If 5 per cent. of the invested amount be added for interest and for decrease in value resulting from wear and tear, and presuming that one car per day is treated in the apparatus, the total expense per car amounts to $8.33. With the old method of cleaning cars infested with vermin, the expense for labor was not only ten times as high, but it was also impossible to be sure that such cars were perfectly and thoroughly cleaned

CAR WHEEL FOUNDRY AND PRACTICE. CHICAGO, MILWAUKEE & ST. PAUL RAILWAY.

BY GEO. L. FOWLER,
Associate Editor of the *Railway Age Gazette.*

The Chicago, Milwaukee & St. Paul is one of the few railways that manufactures its own cast-iron car wheels in quantities; it has a large foundry at the shops in West Milwaukee, Wis., which was built in 1906. The straight floor is used for the molding of the wheels. The building is a brick structure, 158 x 363 ft., with an extension at one end 80 ft. wide. This addition was the old foundry and is used for soft iron work, with which this article will have nothing to do.



Plan of Car Wheel Foundry. Chicago, Milwaukee & St. Paul Railway.

Molding Floors.—The arrangement of the building is clearly shown on the plan. There are 24 floors, each capable of holding 25 wheels. These floors are set 12 ft. between centers and each is served by an overhead trolley and hoist that traverses the building and takes the ladles of hot metal from one side and delivers the hot wheels to the other. Each floor is furnished with its own water boxes, one near each end, and, to avoid wetting or injury from accident, the water is brought in from overhead. There is also a sheltered rack for storing the pattern when it is not in use and a stand for holding the cores until they are needed.

Cupolas.—There are two cupolas, each 98 in. in diameter inside the lining, and set 36 ft. apart between centers. They stand outside the main wall of the building and discharge into a tilting reservoir in the usual manner. This reservoir has a capacity of ten tons when freshly lined, but this drops to about eight tons before relining is considered necessary. The cupola room has a length of 84 ft. and a width of 30 ft.; the details of its arrangement will be considered later. Adjoining the cupola room, on one side, is a wheel breaker housed in an enclosure measuring 8 x 10 ft.; on the other side are the core rooms and ovens.

Annealing Pits.—At one end of the main room are the annealing pits, of which there are 180, arranged in six cross rows. The top platform of the pits is elevated somewhat

above the foundry floor in the usual manner, and the bottom is well below it. The pits are served by three low traveling cranes, each with two hoists, and each serving two lines of pits. Beyond this the end of the building is occupied by the cleaning floor and the toilet and bath rooms.

Industrial Railway.—Extending along the side of the building, next to the cupolas, there is a line of 21-in. gauge track, which is used as a hot metal route. On the other side there is a double track of 24-in. gauge, used for carrying the hot wheels to the annealing pits.

Storage of Material.—Turning now to the details of the arrangements and the methods employed for the work. Just back of the cupola side of the building and set 40 ft. from it there

Pig Metal Storage.

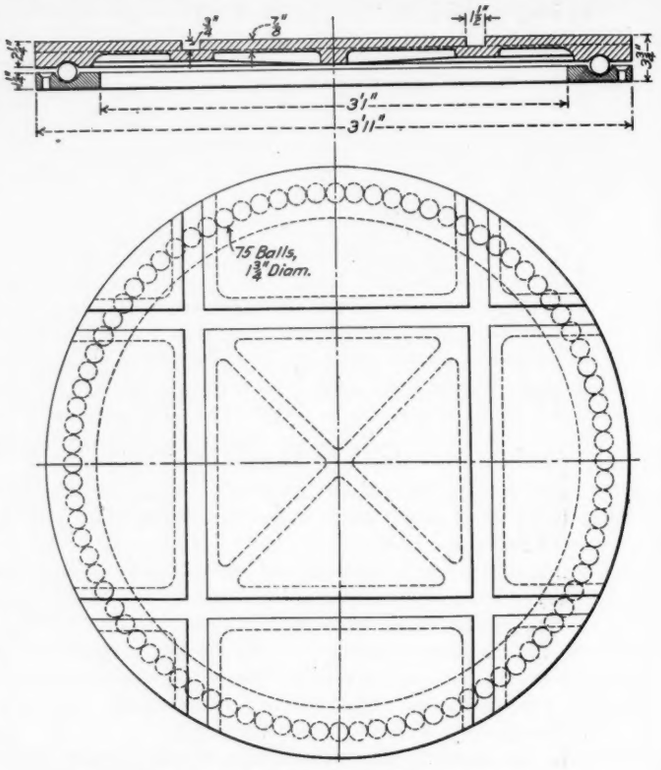
is a track used for the delivery of the material. The space between it and the building immediately adjacent to the cupola room is used for the storage of pig iron. On the other side are the sand sheds, while further along toward the end of the building are the platforms for the storage of old wheels. There are no mechanical facilities for the handling of this material, and the pig metal is taken from the cars and stacked by hand. Owing to the limited space available this has to be neatly done. Each pile is marked with the grade and brand to which it belongs, so that it is readily available for the melter. In the same manner the sand and other bulk supplies are shoveled from the cars into the bins.

The wheels are rolled to the breaker and from there loaded directly upon the charging cars. Though the proximity of the two—the breaker and the cars—is quite intimate, and in the usual course of events the metal is taken direct from the breaker to the charging floor, provision is made for the failure of the supply by the storage of a pile of broken wheels of several hundred tons, so that in case of the disablement of the breaker there will be a supply available to keep the cupolas in operation to the end of the heat. In addition to this precaution there is also another breaker at the other end of the building, which, though ordinarily used for the soft iron foundry, can be used for the wheel work in case of emergency.

Charging Floor.—The broken wheels are loaded with the proper proportion of pigs upon small iron lorreys, which are run in upon an elevator and by it raised to the charging floor. On the charging floor there are two lines of track, running along the outer side of the building and leading from the two elevators, respectively. These are connected at each end with cross tracks and turn-tables so that material can be delivered from either elevator to either track. In ordinary operation, the track next the wall is occupied by a string of cars, loaded with metal, ready for charging. This is a reserve provision, so as to provide iron for the immediate requirements of the cupolas in case of an accident and consequent disablement of the elevators, so that the regular deliveries could not be made. This is supplemented by the storage of a pile of coke on the floor between the cupolas, with which, in case of any delay arising in the delivery of materials between the ground and the cupola, work could be continued. Here, as upon the ground, all material is handled by hand, the charging doors being set well down close to the floor so that the minimum of lifting is required.

After the charging floor had been originally designed, it was found that a better and more frequent communication between the two tracks and the cupolas was desired. As the floor had not been built to stand the concentrated load of a turn-table at any point, a shallow type of table was designed that carried the load at the rim and distributed it over the whole of the circumference. This table, shown in one of the illustrations, consists of a ring for a base, with grooves cut for the balls upon which the table itself is carried. The latter is merely a circular plate, 7/8 in. thick, and ribbed at the rim and at the flangeways to sustain the load, and supported by a continuous line of balls.

Reservoir.—The metal, as tapped from the cupola flows out in a discharge trough, the end of which is well out over the receiving reservoir, so that there is no interference with this flow as the reservoir is tilted for the filling of the pouring ladles. The tilting of the reservoir is accomplished by means



Turntable, Wheel Foundry Charging Room.

of a reversible electric motor driving a worm that meshes with a gear attached to the trunnion. It is operated by an attendant standing upon a shielded platform just above and to one side of the ladle, where he has a clear view of the discharge trough, the reservoir, the ladles and the cars, and the tracks upon which they run to the ends of the building. He also controls the movement of these cars.

Hot Metal Cars.—The hot metal cars are run in trains of four, and are hauled by a wire rope driven by an electric motor. Each car can carry two ladles which have a capacity of about 900 lbs. each, so that they carry enough for the casting of a 700-lb. wheel with its risers. They pour from the top and have a skimming shield at the spout so that they discharge clean metal only into the mold. The cars are con-

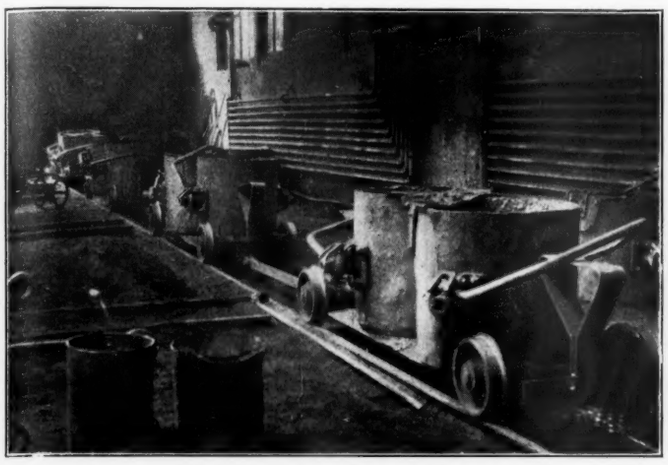
nected by long links and stand 12 ft. apart, from center to center, corresponding to the distance between molding floors.

The method of operation is to put one filled ladle on each car and send the train down to the floors to be served. The molder puts an empty ladle on the car and removes the filled one. While he is pouring the train returns to the cupola, the ladles are filled and the process repeated. In this, of course, the cars are run up and stopped successively in front of the reservoir.

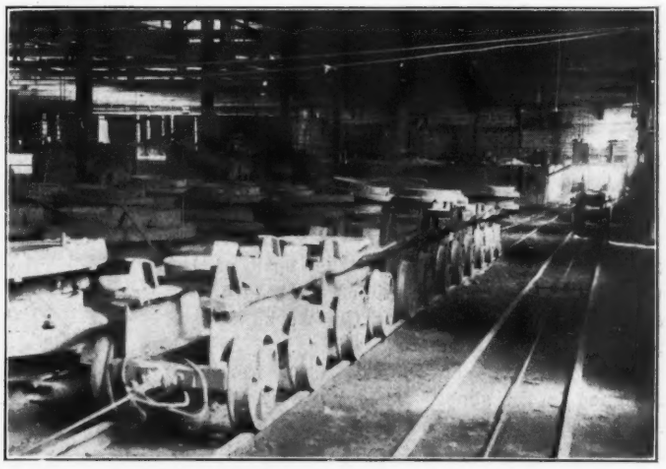
Molding Floor Hoists.—The means of handling the ladles to the molds and the wheels to the pitting tracks consist of the overhead lorrey and hoist already referred to. This consists of a carriage running on rails well above the floor and hauled by a wire rope driven by a drum attached to a line shaft running the whole length of the building along the center line. A clutch serves as the immediate means of attachment and this is so arranged as to be reversible, so that the carriage may be moved in either direction. A single lever serves for either the reversal of the motion or the stopping, according as it is moved to the right or the left, or is brought to the central position. A line leads from this lever to each side of the building and then comes down and across, forming a loop and running about 7 ft. from the floor. This is within easy grasp of the molder, so that he can control the movement of the carriage from any point.

The hoist is effected by means of the rope, A, made fast at one end, and passing over the pulleys, C C, on the carriage and the single fall, D, and thence on to the other side, where it is attached to the piston rod of a pneumatic cylinder. The movement of the piston in this cylinder is controlled by a single three-way valve, which is operated by a line running across the building, parallel and close to the traversing line. With this arrangement the molder can control the hoist and traverse from any point on the floor, and so, though he may follow the ladle to the mold and the hot wheel to the pitting track, he is not obliged to be close to it, thus avoiding much of the heat exhaustion that would otherwise occur.

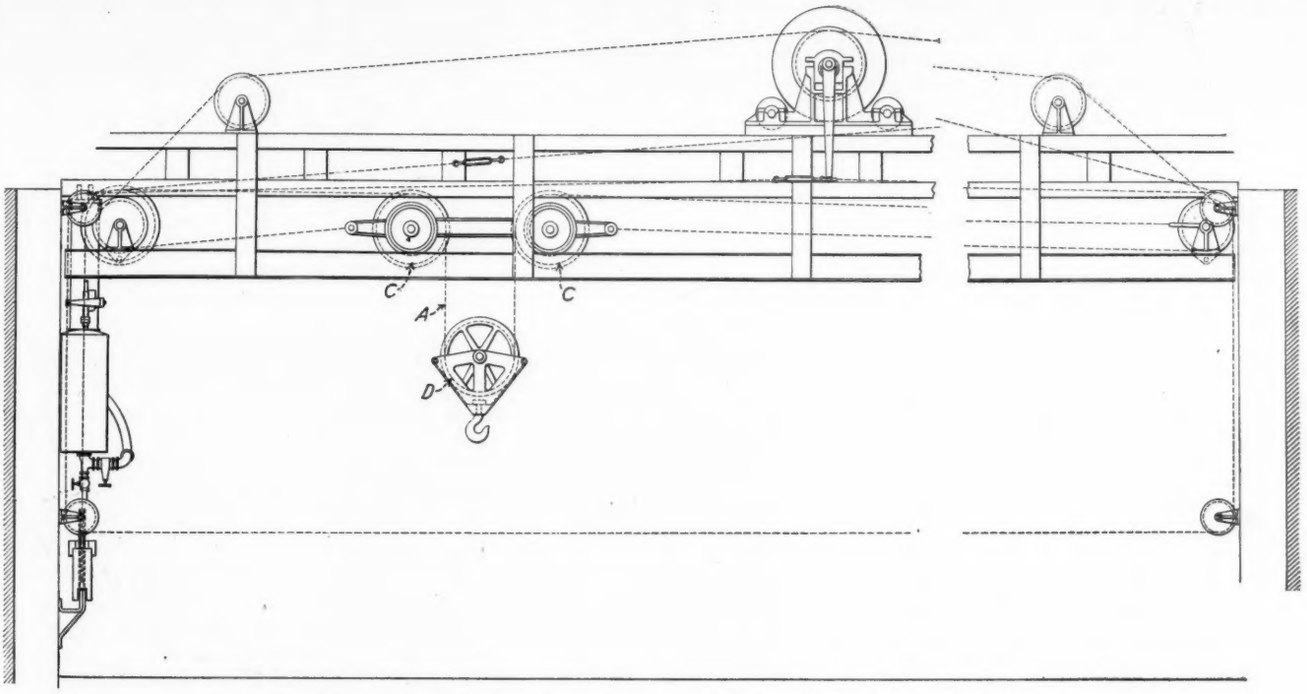
Wheel Tongs.—When the wheel is lifted from the mold it is taken by one point of the rim, instead of at three points, in the usual manner. For this a special form of tongs is used that were designed in the shops. They are arranged to grip the rim of the wheel. After the cope has been lifted off, the end is slipped beneath the rim and the handle, A, is pressed down so as to cause the tongs to nip the wheel. Then, as the hoist lifts on the eye, B, the wheel tilts and the spreader, C, strikes on the handle end of the straight end of the tongs.



Ladle Train, Wheel Foundry.



Hot Wheel Train.



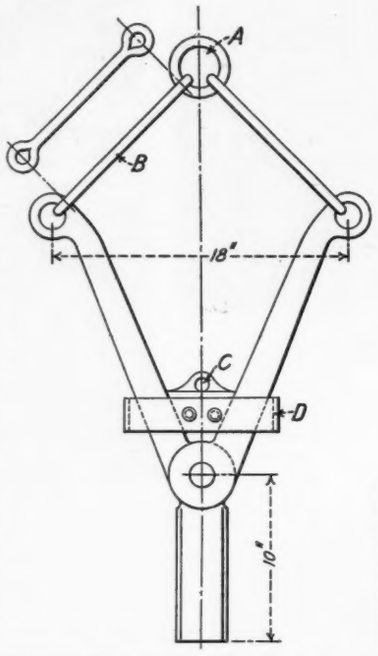
Ladle Crane, Wheel Foundry, Chicago, Milwaukee & St. Paul Railway.

The whole load of the wheel thus tends to hold the tongs tight, and the wheel will be lifted and held securely. When it is lowered to place on the pitting car the tongs automatically let go as soon as the pressure of the spreader is relieved. When the wheel is picked up by the tongs in this manner it stands on edge and the adherent sand is readily knocked off. In striking the wheel to remove the sand, it is always done on the rim on the outside and never on the brackets or the flange.

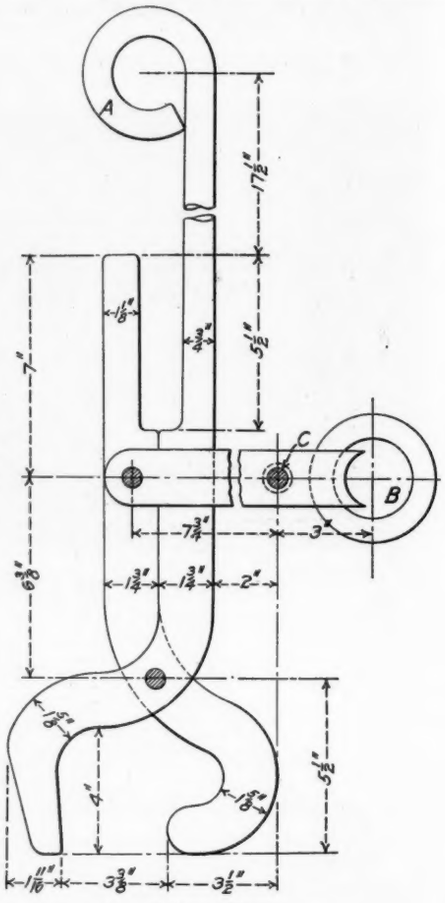
Just before reaching the ends of the annealing pits, the risers are knocked off as the cars pass by a balanced battering ram, swung by a rope and operated by a laborer. He strikes each riser as the wheel passes.

Annealing Pit Cranes.—As already stated, the wheels are picked off the cars by traveling cranes, each carrying two hoists, spaced 6 ft. apart to match the centers of the pits. These cranes are shown in outline in an illustration. They run on an I-beam overhead track, with the carriage hung from the center and coming down close to the top of the pits. On each side the operator is protected from the heat of the wheels by sheet iron shields. An ordinary electric motor, adapted for the work, is used for traversing and hoisting.

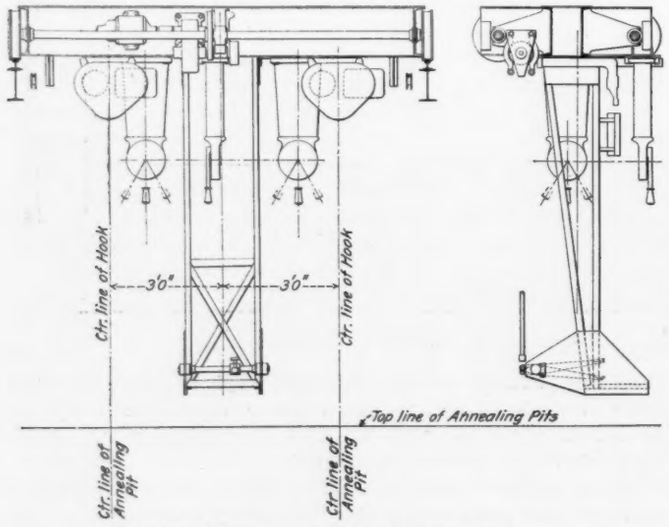
Pitting Tongs.—The pitting tongs were also designed in the shops. They hang by the eye, A, from the hoisting hook, and it will be seen that an upward pull through the links, B, draws the upper arms together and spreads the lower. This would hold for any stress whatever, even to that of the bare weight of the tongs. To prevent this, the wedge block, C, is used. This is made to fit into the angle formed by the upper arms and is held in place by the guide strips, D, that span the arms. This wedge is dropped into the position shown in the engraving when the tongs are to be entered in a wheel hub. When it is down the wedge is lifted by the crane operator by means of a chain and the lower arms of the tongs are immediately spread. Any further lift at A only tends to spread them more and so tighten them that they lift and hold the wheel. When the wheel has been pitted the wedge is allowed to drop back, spreading the upper arms, and so drawing the lower ones together that the tongs can be withdrawn.



Pitting Tongs. Car Wheel Foundry.



Wheel Tongs.



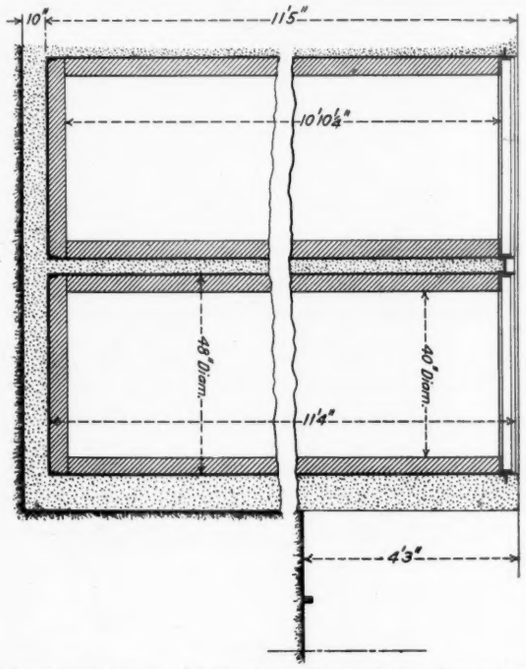
Pitting Crane, Car Wheel Foundry.

Annealing Pits.—The pits are 174 in number, 40 in. in diameter, and each has a depth of 10 ft. 10¼ in. beneath the cover, and a capacity for 16 wheels. This gives a total capacity of 2,784 wheels, or enough for 4½ days' output. Ordinarily, however, the foundry is not working to capacity and the wheels are left in the pits six days. The pits are of the usual type, made of a steel shell lined with firebrick, and packed with dry sand on the outside. As these pits extend down below the natural level of the ground water, special precautions were taken to protect them from moisture. They are enclosed in a concrete box. The sand used was carefully selected and dried, and the whole was kept hot for several days before using. Then on one side, as indicated on the plan, there is a sump to catch the drainage and so relieve the concrete box from the outside pressure and the seepage to which it would otherwise be subjected.

Grinding the Wheels True.—The wheels are removed from the pits by the same cranes with which they were placed, and are carried out to the stacking floor; they are put on two-wheeled trucks and taken to the grinding room, where they are trued by an emery wheel grinder. The management consider this worth the trouble and expense, for while the wheels vary only by an insignificant amount from true rotundity in the rough, they do have the fins due to the contracting chill; the better rolling surface obtained by the grinding is, of course, an advantage for both wheel and rail. The total cost of grinding, including emery wheels, upkeep of machinery and labor is about 2½ cents per wheel.

Pig Iron Used.—So much for the physical means and methods of making wheels at West Milwaukee. The foundry methods are of equal or greater importance. The first point to be considered in this is the choice of the metal. It would not be true to say that in this choice no attention whatever is paid to the chemical analyses of the irons, as they are watched to see that the sulphur does not get beyond bounds, but the basis upon which the wheel mixtures are formed, and upon which, as a sole apparent dependence, the excellence of the wheel relies, is that of the strength of the pig irons used. This is the thing that is looked to first, last and all the time. A sample is taken from every carload of iron received; it is melted in a crucible,

and a test piece cast measuring 2 x 2 x 14 in. This is put upon supports 12 in. apart and broken in transverse stress. This bar must carry at least 18,000 lbs. to be acceptable, though not necessarily to be accepted, as will be noted later. Sometimes, bars 1 in. square are also tested, and these generally show about one-eighth the strength of the larger bar, as they should, though the rule is not invariable. In general,



Construction of Annealing Pits, Wheel Foundry.

the No. 2 irons break at from 16,000 lbs. to 18,000 lbs.; the No. 3, at from 18,000 lbs. to 22,000 lbs., and the No. 4, at from 20,000 lbs. to 24,000 lbs. This, for the usual run of irons, but the Salisbury often goes to 27,000 or 28,000 lbs.

The physical inspection of the iron is also carried to the pigs themselves. Out of a carload lot, a few, 16 or 18, are broken, and the fracture examined. If these run with some uniformity of appearance the carload is accepted as being all of the same character. But, if variations appear, the breaking is continued, and may even extend to every pig on the car. And the iron so inspected is thus re-sorted, according to the number or grade to which each individual piece is shown to belong.

It is on this basis of strength, then, that the irons used in the mixtures are selected, and any new iron to be approved must first show its value in the matter of strength. To test it the usual bars are first broken, then a few wheels are made in an experimental cupola. If these come up to the requirements of the drop and the thermal tests, then other wheels are made and put into service. From this it might appear that any accepted brand would be all right for use in wheels, and that the whole mixture could be made up of that one and scrap. Practical experience, however, has shown that a mixture of several brands will produce a stronger and better wheel than any one alone with the scrap, and the mixtures that are used are those obtained by close observation and testing of results and not from a chemical analysis of the irons used. The mixtures are, therefore, purely empirical.

At the present time only four brands of iron are used, and a typical mixture may be taken, as:

Salisbury	Nos. 3 or 4	10 per cent.
Spring Lake	" 3 " 4	11 "
Shelby	" 2 " 4	9 "
Rock Run	" 3 " 4	10 "
New scrap		12 "
Old wheels		47 "
		100 per cent.

These irons are all charcoal. The Salisbury is from Lime Rock, Conn., but no analyses of this brand could be obtained, either from the railway company or the makers, as none has been made.

The Spring Lake is a Lake Superior iron that would give an average analysis of about:

	No. 3.	No. 4.
Phosphorus	0.191 per cent.	0.192 per cent.
Manganese	.26 "	.26 "
Silicon	.82 "	.68 "
Sulphur	.028 "	.025 "

The Shelby and Rock Run are both Southern irons that are said to be nearly identical, but analyses could not be obtained.

In addition to this inspection for strength, a record is kept of other characteristics of the iron, which are dependent upon

Annealing Pits, Car Wheel Foundry. Chicago, Milwaukee & St. Paul Railway.

the personal equation and judgment of the observer. This record takes: first, the size of the pig, its width, depth and length, also the grade or number of the iron. From the melting in the crucible a block is poured that measures 6 x 3 x 1½ in. This is broken in the middle. The shrinkage of the ends is noted and it is marked 1, 2 or 3, according as it is more or less, the higher figure indicating the greater shrinkage. Then the color of the fracture is taken. If it has a nice dark blue color it is marked 1. This number is increased as the color falls off and approaches a dull gray. The cleanliness is numbered in the same manner. No. 1 is the cleanest, and as dirt appears the number is increased.

As for grain, a smooth even grain is marked 1, and if it is spotted with dullness the number is increased according to the size and area of such spots. The touch of the grain is indicated in the same manner. If it bites into and holds on to the finger, as it is drawn across the surface, like a burr, it is marked 1, and the number is increased as the points of the grain become dull and do not hold.

The fall is a record of the height from which a pig must be dropped to break it, when striking on the center of its length on an anvil block. A typical record of such an inspection would be:

Width, 3 in.	Grade, 3.	Clean, 1.
Depth, 3¾ in.	Shrinkage, 1.	Grain, 2.
Length, 24 in.	Color, 1.	Touch, 1.
Fall, 6 ft.	Breakage, 19,620 lbs.	

One surface of the block is chilled and the fracture of this is noted to determine whether it has a "crystal" chill, which is brilliant and denotes hardness, or whether it is dull and gray, indicating inferiority.

It is not expected that all brands will at all times come up to the standard of strength set by the foundry practice of the road to break at 18,000 lbs., minimum. But, when a carload is received that falls below the requirements, the maker is notified of the fact, and the iron is accepted and worked into the mixtures in smaller percentages, even as low as 1 or 2, than would otherwise be used. In this way the strength of the resulting wheel is not injured.

Scrap Wheels.—In like manner a careful watch is kept over the character of the old wheels that are used as scrap. If these wheels show a close fine-grained fracture and one that indicates that it would be apt to make a deep chill, then Nos. 2 and 3 pig are used for the balance of the mixture; but, if the iron of the wheels runs to an open fracture with an indicated tendency toward a low chill, then Nos. 3 and 4 pig are used. This involves a daily change in the mixture sent to the cupola in order to meet the requirements.

Fuel.—With the iron selected, the next step is the melting. The fuel used is a coke made by the Milwaukee Solvay Coke Co. It is a hard, exceedingly dense, very dark, by-process coke, with a high carbon content. In color it is as dark as the ordinary gas coke, but resembles it in no other particular. It is very strong and bears the burden of the furnace with ease. Its average analysis is about as follows:

Volatile matter	1.82 per cent.
Carbon	88.80 "
Ash	9.38 "
	100.00 per cent.

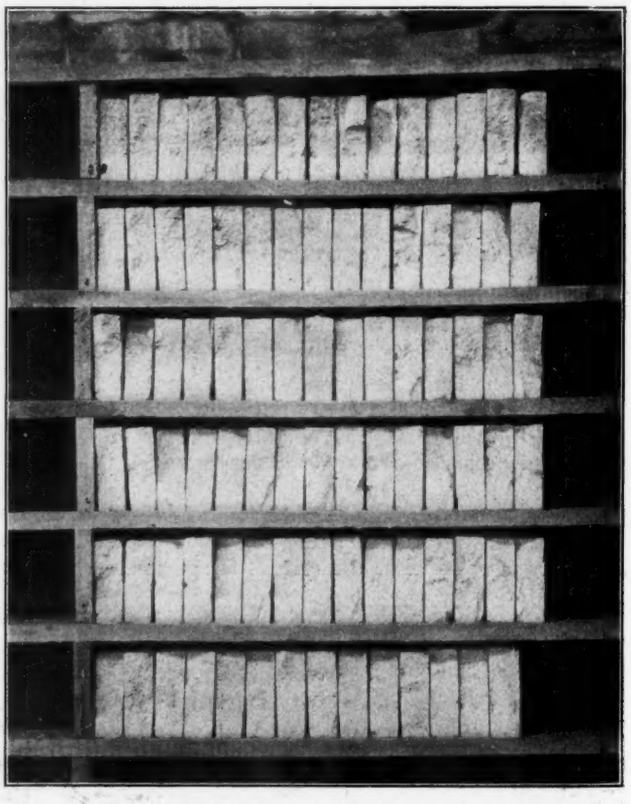
This is typical, though the volatile matter frequently drops as low as 1.32, and it is claimed that the average is 1.40. The carbon often runs as high as 92 per cent., but averages about 90. Such a coke must have good progenitors and is made from a mixture of Pocahontas and Boomer, West Virginia coals, the latter coming from the Eagle and Gas mines. These coals would analyze about as follows:

	Pocahontas.	Boomer.
Moisture	0.27 per cent.	0.79 per cent.
Volatile matter	15.73 "	32.90 "
Fixed carbon	79.80 "	61.05 "
Ash	4.20 "	5.26 "
Sulphur	0.61 "	0.76 "
Phosphorus	0.0045 "	0.009 "
Accounted for	100.6145 "	100.769 "
British thermal units	15,413	14,933

Cupola Charges.—In making up the bed in the cupola the sand bed is 6 in. deep and the first charge of fuel is 6,000 lbs., with a burden of 15,500 lbs. of metal. The following charges are 9,000 lbs. of iron to 900 lbs. of coke. For the average working of the cupola this gives a rate of melting of about 8½ to 1, varying, of course, with the amount. For, as the quantity melted increases, so does the per pound of fuel, frequently rising to above 9 and sometimes falling to below 8 pounds of iron per pound of coke.

Blast.—The blast is furnished by a positive action Root blower, driven direct by an electric motor at a speed of 4,500 revolutions per minute and producing an air pressure for the blast of 10 in. of water. With this the iron comes down in from 5 to 10 minutes after putting on the blast, and the rate of melting will be about 18 tons per hour, with a total output for each cupola of from 105 to 110 tons, with the first tap in about 30 minutes after the putting on of the blast.

Tapping the Cupola.—The metal is tapped from the cupola direct into the reservoir and from there is run into the pouring ladles. As this is about to be done a handful of ferro-manganese is thrown into the bottom of the ladle as it is considered that a better diffusion can be obtained in this way than if it is thrown on the top of the hot metal. The amount varies according to the character of the mixture as determined by the tests that have been cited.



Chill Test Pieces.

Test Pieces.—Close watch is kept of the metal as it comes from the cupola and a test piece measuring 4 x 6 x 1¼ in. is cast from each tap broken, and the depth of chill noted, so that the results are kept remarkably even.

Pouring.—Then, in the pouring of the wheels, great care is exercised to keep the men as far apart as possible, so that one molder will not be injured by the carelessness of his neighbor. The method pursued is this: On the first pouring, for example, the molders of floors 1, 2, 3 and 4 each pour seven wheels in succession from the first metal drawn and as rapidly as they can. Nos. 1 and 3 will pour into molds on the east side of the building, and Nos. 2 and 4 on the west side. This puts a full floor between each two. Then, when the seven wheels

have been poured, Nos. 5, 6, 7 and 8 pour while 1, 2, 3 and 4 are shaking out, and so on down the line. It is the practice to pour the metal very hot and to fill the mold in about 9 seconds.

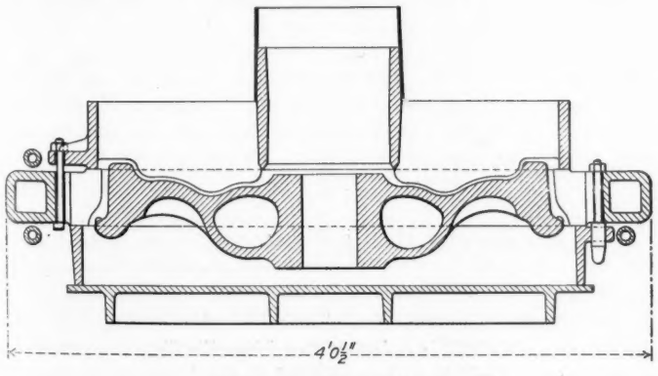
Apprentices.—In the molding and pouring of the metal, all pains are taken to secure the best of results. In the first place there is a regular school of apprentices, so as to insure a supply of skilled workmen. The apprentice first starts in the yard sorting iron, so as to become familiar with the appearances of the different grades. He then goes to the cupola and learns of the methods of mixing and charging. From the cupola he goes to the core room and learns the work of core making, tempering, baking, etc. He then becomes successively a second helper on the floor, first helper, extra molder and finally, when a vacancy occurs, is given a floor. In this way the men are kept interested in the work and are taught carefulness.

Wheels Lost.—Each molder pours his own wheels, handles the hot metal ladles and so can never shirk the responsibility for a lost wheel. This loss is, therefore, very low, running from .5 to .10 per cent., with an average of about .75 per cent.

Chills.—It is well known that the water-cooled contracting chill originated with the late J. N. Barr, who inaugurated the wheel work on the road. When he was alive the foundry was equipped with circular floors and very little trouble was experienced from the water leakages wetting the sand. But, with the introduction of the straight floor, so much trouble was experienced in this way that the use of steam to heat the chill and of water to cool it was abandoned, though the form of chill fitted for such a circulation is still used. It is thought that the circulation of air through this hollow ring has a very decided cooling effect, and so materially assists in holding the chill to size that it is worth retaining. The actual chill is of the usual segmental character with the fingers separated by a saw kerf.

Cores.—The cores used in the wheels are two kinds, differing slightly for the pan and the hub. The pan core is made of 20 parts by volume of sand, and 1 part of rye flour, mixed to the proper consistency with water, and blacked with XX mineral blacking. The hub core is made up of the same proportions, except that while fresh, new river or bank sand is used exclusively in the pan cores, in the hub cores the sand proportions are made up of 8 parts of old burnt core sand and 12 parts of new sand. Both cores are baked in the usual manner on rack carriages, in an open fire oven for from 3 to 4 hours.

Interior of Car Wheel Foundry. Chicago, Milwaukee & St. Paul Railway.



Chill for Car Wheel.

Tests.—The wheels so made stand the M. C. B. thermal test, running from 2¼ to 5 minutes before cracking and withstanding a drop test of from 150 to 175 blows of a 100-lb. drop falling 7 ft., without breaking.

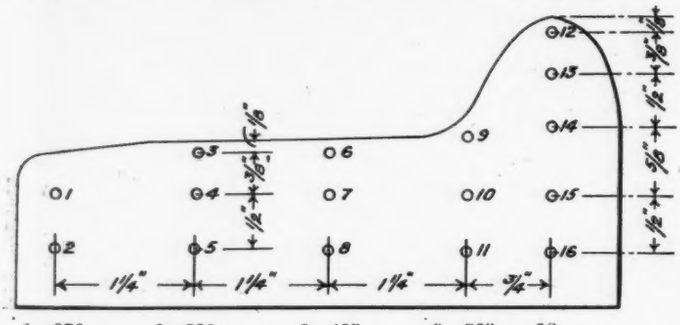
Treatment of the Men.—A part of the good results obtained are attributed to the treatment accorded to the men. They are provided with ample toilet, bath and washroom facilities, of which they take full advantage. The day's work begins at about quarter past six and is over at five. The facilities of the foundry are such that very few men are employed. There is a molder and one helper on each floor, and besides the cupola tenders, the cleaners and pitting men, there are but two or three other laborers about the premises. A record is kept of each man's work, and he is listed according to the percentage of his wheel losses; this list is posted monthly, creating a strong rivalry among them to be at the head.

Physical and Chemical Properties of Wheels.—As for the physical properties of the wheels made here; that they are sat-

isfactory is evidenced by the fact that the company considers it better to make than to buy its wheels. As for the records of service they may be taken as giving an average life of about 80,000 miles. As to the physical and chemical properties of the finished wheels there are no records, but it is assumed that the combined carbon rises about .10 per cent. above, and the silicon drops about .10 per cent. below the average of the mixture, in passing through the cupola.

From this resumé of the conditions obtaining at Milwaukee, it will be seen that the personal factor of the foundryman in charge enters largely into the character of the product and that it would be quite impossible for an outsider to go in and, taking such records as exist, obtain results that would be equal to those that are now produced. That these results are satisfactory to the railway company is evidenced by the fact that the wheels from the Milwaukee foundry are given the preference under the home cars and no wheels are bought from outside parties so long as the capacity of the foundry is up to the demands.

Hardness.—There is also very little data at hand regarding the relative degrees of hardness of the various portions of the tread of a cast-iron wheel. A section of a tread of one of the Milwaukee wheels, that may be considered typical, has been



1—276 2—220 | 3—399 4—373 5—182 | 6—425 7—372 8—200 | 9—562 10—243 11—224 | 12— 13—358 14—330 15—215 16—121

Results of Hardness Tests Made at Various Points on Cast Iron Car Wheel.

taken and subjected to a Brinnell test, the load being applied for 10 seconds in each instance. The results are shown in the accompanying engraving, from which it will be seen that the hardest portion of the section of the wheel is in the chill of the throat and that the hardness tapers down as the edge of the rim is approached. There are indications, however, that possibly the hardest part of the section may have been at the point of the flange, but no record was obtained at this point as the metal chipped off because it did not have strength enough to sustain the pressure of the Brinnell ball. It will be seen, too, that the surface hardness of the metal drops away very rapidly as we go down into the rim. For example, take the three indications at 1¼ in. outside the throat; they drop from 425 at ⅛ in. below the surface to 200 in the gray iron. Tests that were made on the surface of the tread in line with the two rows 1¼ in. and 2½ in. from the throat gave hardness of 591 and 451, respectively, thus checking the indications of a softening of the wheel as we approach the edge of the rim. The probability is that the hardest part of the wheel is in the throat, which is where it would be expected to be because of the intensity of the chilling action at that point. The chill on the wheel tested was very uniform and had a depth of ⅝ in.

LEATHER BELTING.

The difference in the cost of a good and a poor grade of belting is small compared to the expense of maintaining an inferior grade, or of the loss due to belt failures when an inferior grade is used. Two things are necessary in order to keep the cost of maintenance and the number of failures at a minimum. The best quality of belting should be used and its care should be placed in the hands of a specialist, with instructions to prevent failures rather than to remedy them after they have occurred.

The Delaware, Lackawanna & Western, realizing the importance of using the best quality of belting, has recently put into force the following specification, which is more thorough and complete than that ordinarily used.

"All butts used in the construction of this belting shall be of No. 1 selection, free from all defects and blemishes and of the native packer steer hides class, tanned by the slow oak bark process. The shoulder portion of every butt shall be severed at 4 ft. from the tail end, leaving not more than 4 ft. of length to be used in the butt before stretching, and not more than 4 ft. 6 in. after stretching. In the preliminary process of currying the butt shall receive every detail of treatment necessary for the proper setting out and condensation of fiber, in order to insure the greatest possible amount of cohesive strength in the leather. The leather shall be lubricated by processes that will insure the penetration, diffusion and retention of the greases. Nothing shall be used in such lubrications but the pure meat tallow. The leather shall be stretched in straight edged clamps and there shall be no attempt to incorporate any portion of the rear cheek pieces in the lap sections of the belt. Centers and sides must be stretched separately; that is, all the side leather from which widths under 8 in. are to be cut shall be stretched, removed from the influence of the backbone center section and the centers stretched in exactly the size for which they are to be used.

"Every ply of which this belting is constructed shall include the back-bone piece intact, in all sizes 8 in. and above; and in sizes below 8 in. when particularly specified; but, if not so specified, all sizes below 8 in. shall not be cut from any other section but the quality area, which extends not more than 15 in. each side of the back-bone, and all sizes in both single and double must show an even thickness from edge to edge. The same character of leather stock must be used in all doubles on both sides. The strips in every roll of single and double belting shall be matched and graded in order to obtain uniformity by selecting from like location in the belting butt the different cuts for the complete roll of belting, so that each length between laps will be of like texture, caliber and quality; in the construction of all double belting the plies shall be specially matched and graded to insure a level, even and symmetrical construction throughout, and no shims shall be used to fill in or build up to a fictitious thickness. The scarfing, joining and cementing shall be done by expert and experienced workmen; the cement shall be of the best character obtainable, and the press work and accuracy of the laps as perfect as it is possible to obtain in any belt construction.

"All belts shall be subjected to stretch test and tests for straightness of laps under strain of not less than 2,000 lbs. per sq. in. before delivery. Belts must have a tensile strength of not less than 3,800 lbs. per sq. in. in either the leather or the splice, and an elongation of not more than 20 per cent. in 2 in. All belting must bear the manufacturer's brand and name on every 10 ft. The weights for this grade of belting shall be for singles, 16 ozs. to the sq. ft., and in all doubles from 4 in. up, 32 ozs. to the sq. ft., unless otherwise instructed; the weight for doubles below 4 in., 30 ozs. per sq. ft., unless otherwise instructed for lighter weight. All three-ply, 48 ozs. to the sq. ft.

"The manufacturer shall give a guarantee to remedy any defects that may be due to inferiority of material or workmanship at his own expense at any time. All belting must be shipped to Scranton, Pa., for test and inspection. Material which fails to meet all the above requirements will be condemned and returned at the expense of the shipper, he paying freight charges in both directions."

General News Section.

The Pennsylvania Railroad has been experimenting at Altoona with a wireless telegraph; and, with receiving apparatus attached to kites, flown a considerable distance above the surface of the earth, messages were received from a vessel in the gulf of Mexico and from one 600 miles out in the Atlantic ocean.

For the month of January, when weather conditions were severe the percentage of passenger trains in New York State arriving on time, as reported to the Public Service Commission, Second district, was 73. The average delay of each late train was 39.9 minutes, and the average delay for each train run was 10.8 minutes.

The Southern Pacific has let to the A. B. Corey Construction Co., a Utah contracting firm, the contract to build a 28-mile pipe line from Strongknob, Utah, to Lemay. This is an addition to the line built about two years ago from Terrace to Lemay. The line supplies water for locomotive watering stations in the arid region west of the lake, and it is said that when the addition is finished it will be the longest pipe line for water in the United States. The construction company expects to put 500 men to work at once.

At St. Paul on Friday last between 80 and 90 men stood in line, many of them for 24 hours, at the general office of the Northern Pacific, in order to be ready for a good chance in buying some of the 250,000 acres of land in North Dakota and Montana, which was offered for sale by the railway company on that day. Most of these applicants were from towns near the lands offered and many of them were bankers or representatives of bankers. It is said with this sale the last of the big cattle ranges of Montana will be turned into wheat fields.

Near Wilmington, Del., on the afternoon of March 23, the conductor of a Baltimore & Ohio passenger train and the porter of a parlor car on the train were instantly killed with a pistol by a crazy man. After the shooting the murderer barricaded himself in a toilet room, where he held the police of Wilmington at bay, having in his possession a revolver and 100 rounds of ammunition. After detaining the train for over an hour, many shots being fired on both sides, the murderer was dislodged by a stream of water from a fire engine; but he came out still belligerent and had to be shot dead. Two of the policemen were injured by his shots.

Henry Miller, vice-president and general manager of the Wabash, has issued a statement that this road may use the free bridge which the city of St. Louis proposes to construct across the Mississippi river. Mr. Miller's statement is as follows: "If convenient rail connections are available the Wabash will be glad to use the free bridge for the handling of such of its traffic as will be expedited thereby, and, properly worked out, it looks like an excellent way to avoid the tunnel with passenger trains. It was the Wabash which first put St. Louis on the railway map, by instituting the through bill of lading. Immediately after the Wabash took the lead the other eastern roads followed."

Compilations have been made from reports tabulated by the Census Bureau showing in a long list of maladies, that the only one to which the railway employee is more liable than workers in manufacturing or agricultural trades is typhoid fever, and to this he is far less liable than are the workers classed as "laborers." The figures shows that the railway man is far less liable to consumption than workers in the manufacturing and mechanical industries. He is less apt to commit suicide than any other wage earner, and suffers less from rheumatism and malarial fever. His nevrous system, according to the statistics, is in excellent shape. Heart disease and pneumonia are rarer among railway employees than among any other working men.

Daniel Willard, president of the Baltimore & Ohio, and other officers of the road made a thorough inspection last week of the property of the Chicago Terminal Transfer, which has now passed entirely into the control of the Baltimore & Ohio. While in Chicago Mr. Willard said that it had been decided to make extensive improvements in the Terminal Transfer property. It has not yet been decided whether the road will be operated as a division of the Baltimore & Ohio or under a separate organization; he thought the latter plan would be adopted. The road in future will be known as the Baltimore & Ohio Chicago Terminal Railroad. It is still being operated by John N. Faithorn, its receiver, but it is expected that the receivership will be terminated about April 1.

A Specialist in Prevention of Accidents.

R. C. Richards, general claim agent of the Chicago & North Western, will in future devote most of his time to the study of the causes of accidents on this road and to the devising and application of methods for preventing them. As stated in another column, H. C. Howe has been appointed freight claim agent, relieving Mr. Richards of the duties incident to the handling of claims for loss and damage to freight and giving him more time to devote to personal injury claims and claims for damage to property other than freight claims. Mr. Richards will spend more of his time in future on the road, where he will get employees together, call their attention to means by which accidents which have happened could have been avoided and conduct a general campaign of education for the elimination of accidents. In particular, he will try to devise ways for reducing the number of accidents to employees.

Two Miles in Less Than a Minute.

At Ormond, Fla., March 23, Barney Oldfield, in his Benz automobile, traversed two miles in 55.38 seconds, or at the rate of 130.01 miles an hour, breaking all records for two miles. He also broke another record by covering one kilometer in 17.04 seconds, or at the rate of 131.29 miles an hour. The record for one mile, made by Oldfield March 16, and reported in a previous issue (131.72 miles an hour) was something more than one mile an hour better than the best previous speed with any kind of a vehicle ever run by man on the surface of the earth, the best time reported by the electric railway car between Berlin and Zossen, Germany, in 1903, being at the rate of 130½ miles an hour.

The Ormond despatch, of March 23, says that George Robertson traversed one mile in 30.39 seconds in Walter Christie's car, making the best time for one mile ever recorded for an American built car.

Railway Matters in Washington.

Washington, March 30, 1910.

The house committee finally reported the Interstate Commerce bill March 24, with many of the sections rewritten. The changes which have been made by the committee deal with matters of detail. It will be hardly worth while to rehearse these details at this time, for it is said that the objections which have been presented in the Senate will result in the drafting of numerous amendments in the Senate bill, designed to meet these objections; and the proposed new amendments are to be drafted, it is said, by Attorney-General Wickersham, the primary author of both the House and the Senate bills. The Senate still remains in the listless attitude which has characterized it all along, but an attempt to limit debate and set a date for taking a vote was defeated. It is said that Senator Root, of New York, will address the Senate on the bill this week. Senator Bailey, of Texas, a leader of the Democrats, is expected also to speak. President Taft is becoming a trifle impatient, aand it is reported that he is now urging members to get the bill passed in some shape in both houses, and then, if necessary, send the whole subject to a conference committee.

Chairman Mann, of the house committee, has decided to ask.

next Monday, for unanimous consent to the consideration of the bill.

The proposition to restrict the publicity of corporation returns made under the corporation tax law, has now taken another shape; Senator La Follette, of Wisconsin, has procured the insertion in the appropriation bill of a clause making the tax returns public "when called for by resolution of the Senate or House"; and presumably not otherwise.

Increases of Railway Employees' Pay.

The Pennsylvania Railroad has made a voluntary increase of 6 per cent. in the pay of all employees who now get less than $300 a month, the increase to take effect April 1. This applies to all employees regardless of how their pay is computed. It is understood that a similar advance will be made on the lines west of Pittsburg, thus affecting about 175,000 men. On the lines east of Pittsburg the company employs about 123,000 men, and on the western lines there are 58,000 more.

In 1907 the Pennsylvania Railroad made a horizontal increase of 10 per cent. in the pay of employees. During the last few months the Pennsylvania has made some wage adjustments with its locomotive engineers.

Following the negotiations of the past few weeks, it was announced in New Haven this week that the conductors, trainmen and yardmen of the New York, New Haven & Hartford would be granted increases of pay amounting to $500,000 a year, said to be 15 per cent. of the total amount now being paid out for wages—meaning, presumably, the wages paid to these classes. The pay of passenger conductors is increased from $3.60 a day to $4.20 per 100 miles; ticket collectors from $2.40 to $3.35; baggage masters from $2.40 to $2.75; passenger brakemen from $2.20 to $2.55; freight conductors from 3.55 cents a mile to 3.63 cents a mile; freight flagmen from $2.45 to $2.52½; brakemen from $2.35 to $2.42. Men engaged on work trains and in similar work are to have their working day reduced from 11 hours to 10.

Members of the Order of Railway Conductors and of the Brotherhood of Railway Trainmen on the New York Central are this week voting on the question whether to accept a compromise proposed by the officers of the road. It is said that these employees have demanded twice as large an increase in pay as the company is willing to grant. The leaders of the trainmen say that their minimum demand is for the same increase that has been or will be agreed to on the Baltimore & Ohio.

The Board of Arbitration, reporting on the controversy between the Cleveland, Cincinnati, Chicago & St. Louis and its telegraph operators, made a report on Monday of this week. The telegraphers will get a considerable increase. On the same day that this decision was announced another press despatch represented the same road as demanding increases in pay.

A press despatch from Winnipeg says that all of the unions of mechanics on both the Canadian Pacific and the Canadian Northern have formed an alliance to demand increases of pay. About 15,000 men are involved, and they say that they are now well organized and do not expect to repeat the failure of two years ago.

The Canadian Pacific, the Grand Trunk and the Toronto, Hamilton & Buffalo will next week begin arbitration with certain of their employees concerning wages. These arbitrations are carried out under the Lemieux act. The representative of the three railways is Wallace Nesbitt, a lawyer.

A press despatch from Denver says that the Brotherhood of Railroad Trainmen has asked for an increase of pay on the Colorado & Southern, and that similar requests will be made of the Chicago, Burlington & Quincy, the Union Pacific and the Denver & Rio Grande.

The conductors and trainmen of the Cleveland, Cincinnati, Chicago & St. Louis are this week voting on the question of approving the action of their leaders in demanding from the company higher rates of pay than the company has yet agreed to.

Committees of the conductors' and brakemen's brotherhoods have presented an application for higher pay to the general manager of the Lake Shore & Michigan Southern.

The Joint Adjustment Committee of the employees of the Boston & Maine is urging on the officers of the company a request for 10 per cent. increase in pay.

Telegraphers on the Southern Railway are voting on the question of accepting a 5 per cent. increase in wages offered by the company.

Committees of the Brotherhood of Locomotive Engineers have asked the Erie road for an increase of pay.

The Western Maryland has made an increase of 8 per cent. in the pay of its 200 locomotive engineers.

The Firemen's Brotherhood has secured concessions in regard to wages from the Lehigh Valley.

The railways entering Chicago which were concerned in the arbitration by the Illinois Board of Arbitration of the wages to be paid their switchmen, have consented to pay these employees the same rates as have been awarded by the federal board of arbitration to switchmen employed by other roads in the Chicago district. As noted last week, pages 841 and 842, the Illinois board awarded switchmen belonging to the Brotherhood of Railroad Trainmen an increase of two cents an hour, while a board organized under the Federal law awarded switchmen on other roads in the Chicago district an advance of three cents an hour. This greater advance, under the new arrangement, will be given to all.

In return for this concession in wages by the railways, the members of the Brotherhood of Railroad Trainmen have consented to a modification of certain rules in the agreement signed by their representatives and those of the railways on March 19. The agreement then signed provided that yardmen should be paid pro rata for over-time and that any time less than 30 minutes should be paid for as a half hour. It also provided that more than a half hour over-time should be paid for as an hour. The rule as changed provides that yardmen shall be paid pro rata for over-time, actual minutes to be counted. One of the rules in the agreement signed on March 19 read as follows:

"Ten hours or less shall constitute a day's work, and the duties assigned to each crew shall be such as not to require a longer day's work under average conditions. No new work shall be assigned after the expiration of ten hours, nor, excepting in cases of emergency, shall any new work be assigned shortly before the expiration of ten hours if such assignment shall cause the men to work overtime."

This rule has been revised under the new agreement so as to read as follows:

"Ten hours or less shall constitute a day's work. No new work shall be assigned after the expiration of ten hours."

Switchmen of the Indiana Harbor Belt were left out of the new agreement, as officers of this road were not able to attend the conference.

On March 24 an agreement was signed by the representatives of 49 western railways and the representatives of the firemen employed by these roads binding them to terms of settlement of the controversy over wages and conditions of employment between them. The negotiations had been going on since March 17. Under the terms of the agreement the question of an increase in wages will go to arbitration under the Erdman act. The rule of seniority to be applied was settled, but has not been made public. The question of the representation of members of the Brotherhood of Firemen who have become enginemen is understood to remain unsettled.

A. J. Earling on Conditions on the Chicago, Milwaukee & Puget Sound.

President A. J. Earling, of the Chicago, Milwaukee & St. Paul, in an interview at Seattle during his recent western trip, said that the Chicago, Milwaukee & Puget Sound will confine its building operations in 1910 largely to the completion of the branch lines now under construction or authorized.

"For some time," Mr. Earling said, "there has existed a sensitive situation, together with a lack of confidence in eastern financial circles, and it is hard to find a market for railway securities. No such situation exists in the west. Conditions here could not well be better. Operating conditions on the Milwaukee's coast extension are much better than I had been led to believe. The last of the interruptions to

traffic has been cleared away. Although conditions on the west end of the line were bad during the latter part of February and the early part of March, as on the other northern roads, they quickly improved. The winter in the northwest east of the Missouri river was the worst I have seen in forty-five years."

Mr. Earling denied rumors that the Chicago, Milwaukee & Puget Sound had purchased the Idaho, Washington & Northern and the Washington, Idaho & Montana.

"The Milwaukee has been promised the last of its equipment for the Seattle-Chicago through passenger service by June 15," he said, "and we ought to be ready to inaugurate through passenger service by July 1, or shortly thereafter. Meantime we shall put the roadbed west of Mobridge in the very best of condition for the fast operation of passenger and mail trains. The service will include two through trains between Seattle and Chicago each way per day, in addition to the present local trains.

"We have planned a campaign of advertising and exploitation of Washington and the whole Pacific northwest for this year."

Labor Legislation of 1908 and 1909.

Bulletin No. 85 of the United States Bureau of Labor reviews the labor legislation of the country during the past two years. An increasing uniformity in the provisions of such legislation is clearly in evidence.

Commissions to investigate the liability of employers for injuries to their employees and better methods of compensating employees for the results of accidents were appointed in Minnesota and New York, while Wisconsin had a similar body at work under an earlier appointment. The co-operation of these commissions, though not at all provided for in the laws creating them, has been a practical economy in the matter of conducting investigations. Arizona, Illinois and Ohio assigned the conditions and regulation of mine labor to commissions for investigation and report.

Five states (Michigan, Texas, Idaho, Maine and New Jersey) and the Philippine Islands passed laws affecting employers liability directly; while in Georgia, Iowa, Massachusetts, Mississippi, Ohio and South Dakota the customary defenses of employers in suits for damages by injured employees, i. e., fellow-service, assumed risks and contributory negligence, were more or less restricted or modified. The doctrine of comparative negligence, with a corresponding award of damages, has been incorporated in the laws of Texas, Iowa and Ohio, and in a modified form in Georgia.

A statute of Montana provides for a state co-operative insurance fund to be maintained by coal-mine operators and their employees and administered by state officials.

More than fifty separate laws were passed by the legislatures of various states within the past two years regulating the conditions of employment in factories and mercantile establishments. Laws providing for a higher standard of ventilation, and requiring artificial ventilation where necessary, were passed in Illinois and Minnesota. A law was enacted in Oklahoma, prohibiting the sending of workmen into steam boilers, fireboxes, etc., before the steam is exhausted or the fire drawn.

Massachusetts enacted a new law requiring the water used for humidifying the air in workrooms to be so pure as not to give rise to impure or foul odors.

The safety of employees in mines is the subject of a number of laws. The increasing employment of electricity for lighting and other uses in mines received attention in Idaho, Ohio and Oklahoma, where proper insulation and other precautions are prescribed. Safety lamps, explosives and blasting, ventilation, inspection and the exclusion of intoxicants and intoxicated persons are features of several laws relating to mines. A number of states require mine employees to secure certificates of competency before being employed. The New York legislature enacted a law, the first of its class in the United States, governing the employment of workmen in mines and tunnels where compressed air is used; the hours of labor per day are regulated according to the degree of air pressure, and provision is made against too sudden changes from the place of work to open air; medical examinations prior to employment or re-employment after an absence of three or more days, as well as after each three months' continuous employment, are prescribed.

Laws regulating railway employment were passed by several states, three principal features being a determination of the number of persons necessary to constitute crews on trains, the provision of adequate headlights on locomotives, and regulation of the size, construction and equipment of cabooses. Safety appliances, as brakes, couplers and ash pans on locomotives are other provisions of laws of this class.

Four states (Connecticut, Mississippi, North Carolina and Texas) passed laws prohibiting blacklisting, while conspiracy, intimidation and interference with employment are subjects of other laws. In the class last named is a law enacted by Congress making it an offense to entice employees in arsenals or armories to leave service during the term of their employment, or to avoid or break their contracts. Hiring, retaining or employing or harboring in any wise such workmen during their term of service is also forbidden.

The giving of a commission or bonus to domestic servants or others making purchases for their employers is made an offense in New Jersey and Washington, the receiving of tips by waiters in hotels and restaurants and the giving of such tips being also prohibited in the latter state.

On the employment of women and children thirty-two states have enacted fifty-four laws or amendments thereon in the past two years. Extended and detailed lists of employments prohibited for children appear in the legislation of New York, North Dakota, Ohio, Oklahoma and Pennsylvania, and in a number of states new laws are added prohibiting night work. Other laws relate to the negligence of employees, the reporting of accidents, the control of private employment agencies, the protection against discharge by employers or exclusion by labor unions of workmen who are or may become members of the national guard, and the protection of employees on building construction.

Average Pay of Enginemen in New York.

The pay-roll of one of the large railways terminating in New York City has been analyzed, and averages computed on the basis of actual time worked. This road guarantees its engineers a minimum of $4 a day. The following table shows average selections of enginemen running freight trains in the month of December.

Freight Runs.

Enginemen.	No. of days worked.	Time, in hours.	Amt. earned in month.	Average pay per hour in service.
Allen	26	188	$128.66	$0.68
Bond	27	335	196.56	.59
Camp	25	257	137.32	.53
Dent	29	241	121.44	.50
Earl	25	285	135.89	.48
Fisk	31	263	128.96	.49
Gill	25	274	110.76	.40

Passenger Runs.

Enginemen.	No. of days worked.	Actual time in hours.	Amt. earned in month.	Average pay per actual hour worked.
Hope	16	96	$170.35	$1.77
Ives	15	105	126.95	1.21
Jenks	18	160	170.59	1.07
Kent	28	121	196.56	1.62
Lent	24	96	172.85	1.80
Moon	28	166	161.58	.97
Nelson	29	89	119.42	1.34
Oakes	30	115	117.86	1.02

It is seen from this table that the pay varies from $0.97 to $1.80 per hour. On a daily basis of 10 hours, this would be $9.70 and $18 a day respectively.

Delegates to the International Railway Congress.

The Secretary of State, supplementing his former announcement of the appointment of Messrs. Lane, Clark, Harrison, Garrett, Brown and Haines, announces the appointment of three additional delegates to the congress, to be held at Berne next July; namely, W. F. Schleiter, secretary of Dilworth, Porter & Co., Ltd., Pittsburgh, Pa.; C. A. Severance, lawyer, St. Paul, Minn., and William C. Kuntz, Steelton, Pa. Mr. Kuntz is now sales agent of the Pennsylvania Steel Co., but

expects soon to discontinue his service with that company and to take a position with the Goldschmidt Thermit Co., New York City.

Approval of the Burr Mail Delivery Apparatus.

The Burr device for delivering mail bags from moving cars, which was described in the *Railway Age Gazette* October 15 last, page 715, has been approved by the Postmaster-General, and can now be introduced by any railway company which sees fit to adopt it. This apparatus has been in use regularly on the Chicago, Rock Island & Pacific between Davenport, Iowa, and Union Pacific Transfer, for nearly a year and intermittently for about four years.

This device operates by compressed air. The mail bags to be left at a station are piled on an iron grating or apron which, when at rest, hangs down along the side of the mail car and forms the door step to the side door. When pulled up in position to be loaded it lies on the floor of the car, projecting out of the door about ten inches. A chain and lever connects this platform with the compressed air cylinder, which, when power is applied, pulls the apron outward and downward, delivering the mail in a box or trough prepared for it, or upon the ground. The air pressure is furnished by the air brake system. If a box is used at a station, the side of the box nearest the track serves to prevent bags from falling under the wheels of the train. If no box is used then a guard railing is put up at the point where the mail is dumped. The air power is applied by a trigger, which, when at rest, lies along side of the car about on a level with the bottom of the car sills. This trigger when set for operation, just before reaching a station, projects about twenty inches from the side of the car, and when it reaches the place where the mail is to be dropped engages with a sloping rod fixed on a post and arranged parallel with the track. The trigger slides up this sloping rod until the motion is sufficient to open the valve of the compressed air reservoir.

The catching device does not differ materially from others now in use.

A Correction.

In the daily edition of the *Railway Age Gazette* of March 17, page 686, the Hon. George P. Graham, minister of railways and canals of Canada, was quoted as saying that the new Quebec bridge would have a span of nearly 800 ft. The figure should have been 1,800 ft.

American Railway Tool Foremen's Association.

This association was organized in Chicago on December 7, 1909, with 39 charter members. The next meeting will be held in Chicago, July 12, 1910, when papers on the following subjects will be presented and discussed: The Tool Check System; Special Tools for Railway Work; Treatment of Steel; The Tool Room—Past, Present and Future; Pneumatic Tool Repairs; High Speed Steel; Railway Legislation and the Railway Employee. Tool foremen who are not identified with this association are urged to communicate with the secretary-treasurer, O. T. Harroun, tool foreman, C. & A. Ry., Bloomington, Ill. The other officers are: President, F. J. Powell, of the El Paso & Southwestern, at El Paso, Tex.; first vice-president, M. H. Bray, New Haven, Conn.; second vice-president, A. W. Meitz, Grand Rapids, Mich.; third vice-president, John T. Fuhrman, St. Paul, Minn.; chairman of executive committee, J. W. Pike, Silvis, Ill.

American Association of General Passenger and Ticket Agents.

At the annual convention, held in Havana, Cuba, on March 28, the following officers were elected: President, Samuel Moody, Pennsylvania Railroad; vice-president, C. A. Cairns, Chicago North Western; secretary, C. M. Burt, Boston & Maine (re-elected). It was decided to hold the next annual convention at St. Paul.

MEETINGS AND CONVENTIONS.

The following list gives names of secretaries, dates of next or regular meetings, and places of meeting.

Air Brake Association.—F. M. Nellis, 53 State St., Boston, Mass.; May 10-13; Indianapolis.
American Association of Demurrage Officers.—A. G. Thomason, Scranton, Pa.; June, 1910; Niagara Falls, Ont.
American Association of General Passenger and Ticket Agents.—C. M. Burt, Boston, Mass.
American Assoc. of Local Freight Agents' Ass'ns.—G. W. Dennison, Penna. Co., Toledo, Ohio.
American Ass'n of Railroad Superintendents.—O. G. Fetter, Carew Bldg., Cincinnati, Ohio.
American Institute of Electrical Engineers.—R. W. Pope, 33 West 39th St., N. Y.; 2d Friday in month; New York; March 30-April 1; Charlotte, N. C.
American Railway Association.—W. F. Allen, 24 Park Place, New York; May 18; New York.
American Railway Bridge and Building Association.—S. F. Patterson, B. & M., Concord, N. H.
American Railway Engineering and Maint. of Way Assoc.—E. H. Fritch, Monadnock Bldg., Chicago.
American Railway Industrial Association.—G. L. Stewart, St. L. S. W. Ry., St. Louis; second Tuesday, May; Memphis, Tenn.
American Railway Master Mechanics' Association.—J. W. Taylor, Old Colony Building, Chicago; June 20-22; Atlantic City.
American Railway Tool Foremen's Association.—O. T. Harroun, Bloomington, Ill.; July 12; Chicago.
American Society for Testing Materials.—Prof. Edgar Marburg, Univ. of Pa., Philadelphia.
American Society of Civil Engineers.—C. W. Hunt, 220 W. 57th St., N. Y.; 1st and 3d Wed., except July and August; New York.
American Society of Mechanical Engineers.—Calvin W. Rice, 29 W. 39th St., N. Y.; 2d Tues. in month; New York; May 31-June 3; Atlantic City.
American Street and Interurban Railway Association.—B. V. Swenson, 29 W. 39th St., New York.
Association of Am. Ry. Accounting Officers.—C. G. Phillips, 143 Dearborn St., Chicago; June 29, 1910; Colorado Springs.
Association of Railway Claim Agents.—E. H. Hemus, A., T. & S. F., Topeka, Kan.; May 25-27; Chattanooga, Tenn.
Association of Railway Telegraph Superintendents.—P. W. Drew, Wisconsin Central Ry., Chicago; May 16-20, 1910; Los Angeles.
Association of Transportation and Car Accounting Officers.—G. P. Conard, 24 Park Place, N. Y.
Buffalo Transportation Club.—J. N. Sells, Buffalo.
Canadian Railway Club.—James Powell, Grand Trunk Ry., Montreal, Que.; 1st Tues. in month, except June, July and Aug.; Montreal.
Canadian Society of Civil Engineers.—Clement H. McLeod, Montreal, Que.; irregular, usually weekly; Montreal.
Central Railway Club.—H. D. Vought, 95 Liberty St., New York; 2d Friday in January, March, May, Sept. and Nov.; Buffalo.
Engineers' Society of Western Pennsylvania.—E. K. Hiles, 803 Fulton Bldg., Pittsburgh
Freight Claim Association.—Warren P. Taylor, Rich., Fred. & Pot. R. R., Richmond, Va.; June 15, 1910; California.
International Master Boiler Makers' Association.—Harry D. Vought, 95 Liberty St., N. Y.; May 24-27; Niagara Falls, Ont.
International Railway Master Blacksmiths' Ass'n.—A. L. Woodworth, Lima, Ohio; Aug. 16-18; Detroit, Mich.
International Railway Fuel Association.—D. B. Sebastian, La Salle St. Station, Chicago; May 23-26; Chicago.
International Railway General Foremen's Association.—L. H. Bryan, D. & I. R. Ry., Two Harbors, Minn.; May; Cincinnati.
International Railway Congress.—Executive Committee, rue de Louvain, 11, Brussels; July 4-16; Berne, Switzerland.
Iowa Railway Club.—W. B. Harrison, Union Station, Des Moines, Ia.; 2d Friday in month, except July and August; Des Moines.
Master Car Builders' Association.—J. W. Taylor, Old Colony Bldg., Chicago; June 15-17; Atlantic City.
New England Railroad Club.—G. H. Frazier, 10 Oliver St., Boston, Mass., 2d Tues. in month, ex. June, July, Aug. and Sept.; Boston.
New York Railroad Club.—H. D. Vought, 95 Liberty St., New York; 3d Friday in month, except June, July and August; New York.
North-West Railway Club.—T. W. Flanagan, Soo Line, Minn.; 1st Tues. after 2d Mon., ex. June, July, August; St. Paul and Minn.
Northern Railway Club.—Fourth Saturday in month; Duluth, Minn.
Omaha Railway Club.—A. H. Christiansen, Barker Blk.; 2d Wednesday in month.
Railroad Club of Kansas City.—Third Friday in month; Kansas City.
Railway Club of Pittsburgh.—J. D. Conway, Pittsburgh, Pa.; 4th Friday in month, except June, July and August; Pittsburgh.
Railway Signal Association.—C. C. Rosenberg, 12 North Linden St., Bethlehem, Pa.
Railway Storekeepers' Association.—J. P. Murphy, Box C., Collinwood, Ohio; May 16-18; St. Louis.
Railway Telegraph and Telephone Appliance Ass'n.—H. M. Buck, Secy.-Treas., 30 Church street, New York.
Roadmasters' and Maintenance of Way Association.—Walter E Emery, P. & P. U. Ry., Peoria, Ill.
St. Louis Railway Club.—B. W. Frauenthal, Union Station, St. Louis, Mo.; 2d Friday in month, except June, July and Aug.; St. Louis.
Society of Railway Financial Officers.—C. Norquist, Chicago.
Southern Association of Car Service Officers.—J. H. O'Donnell, Bogalusa, La.
Southern & Southwestern R.R. Club.—A. J. Merrill, Prudential Bldg., Atlanta; 3d Thurs., Jan., Mar., July, Sept. and Nov.; Atlanta.
Traffic Club of New York.—C. A. Swope.
Traveling Engineers' Association.—W. O. Thompson, N. Y. C. & H. R. R.R., East Buffalo, N. Y.
Western Canada Railway Club.—W. H. Rosevear, P. O. Box 1707, Winnipeg; 2d Monday, except June, July and August; Winnipeg.
Western Railway Club.—J. W. Taylor, Old Colony Bldg., Chicago; 3d Tuesday each month, except June, July and August; Chicago.
Western Society of Engineers.—J. H. Warder, Monadnock Bldg., Chicago, 1st Wednesday, except July and August; Chicago.

Traffic News.

The joint committee representing the municipal assembly and the shippers of St. Louis, which has been appointed to confer with the railways with a view to securing the abolition of all bridge arbitraries across the Mississippi river, has voted to entertain no proposition from the railways which does not include the entire abolition of these arbitraries.

Massachusetts, sometimes spoken of as a state of abandoned farms, is the scene of the latest Farmers' Special. The Boston & Albany, with a train "laden with wisdom, wise men and instructive exhibits," carrying Professor Hurd and other experts from the State Agricultural College, is this week making a four days' trip over its main line and principal branches. At North Adams and Worcester evening meetings were held.

The Traffic Club of Chicago at its meeting this week elected the following officers for the ensuing year: President, John T. Stockton; First Vice-President, Frank P. Eyman; Second Vice-President, W. M. Hopkins; Third Vice-President, G. K. Sage; Treasurer, John H. Grace; Secretary, Guy S. McCabe; Directors, O. F. Bell, J. Charles Maddison, W. H. Johnson and Geo. E. White.

Representatives of the railways estimate that more than 130,000 head of cattle will be shipped from the ranches south and west of San Antonio, Tex., to Oklahoma during the four weeks ending about April 15. Shippers have already ordered over 4,500 cars and the roads are receiving additional orders daily. This heavy movement of stock is due to a scarcity of grass upon the ranges, caused by a shortage of rain fall during the past winter.

The Lehigh Valley, not content with such temporary measures as running special trains for the instruction of farmers, has established a permanent agricultural department and has appointed as the head of it F. R. Stevens, heretofore a traveling agent of the New York State Department of Agriculture. Mr. Stevens will devote his time principally to giving lectures to farmers an following up the lectures with such individual conferences or instruction as may be found desirable or necessary.

J. M. Glenn, secretary of the Illinois Manufacturers' Association, has issued a circular saying that an advance in the freight rates of the differential lines between Chicago and New York was prevented by the Grand Trunk, and suggesting that members who are interested "give the Grand Trunk System all the moral as well as material encouragement they can to aid it in maintaining the stand it has taken." Mr. Glenn has also issued a circular protesting against the advance in rates on coal from Illinois and Indiana points.

The Niagara Frontier Shippers' Traffic Association has complained to the New York State Public Service Commission against the adoption of the National Car Demurrage rules by the railways in and around Buffalo. Complainants declare that the rule allowing the railways to notify the consignee on the arrival of a car instead of after it is placed for unloading is unlawful, as also the rule allowing the road to set a car on some other track when the usual track is occupied. It is also claimed that the note estopping a consignee from complaining of the insufficiency of a notice does not adequately cover the subject.

Business men of Kansas City have subscribed $1,000,000 to a fund to maintain a line of freight boats on the Missouri river between that city and St. Louis. The use of this stream as a highway for transporting freight at rates lower than those charged by the railways has been agitated by Kansas City merchants for two years. When the full amount was assured a big demonstration was held at the boat line headquarters, and United States Senator Burton was telegraphed to, reminding him of his "promise to Kansas City, made in December, 1906, of a government appropriation for the Missouri river if Kansas City would use the river."

Adrian Gips, general agent of the Holland-America Steamship Line at New York, has been fined $4,000 for receiving rebates on shipments of freight over the Central Vermont and the Wabash. Counsel for the defendant claimed that it was doubtful whether the steamship company should be regarded as a shipper, but did not press the point, and advised Gips to plead guilty, which he did. This is the same case in which certain officers of the railway companies have been indicted. On Tuesday David O. Ives, now with the Merchants' Association, of Boston, and formerly traffic manager of the Wabash, pleaded guilty before Judge Holt in the federal court at New York to paying a rebate to the steamship company, and was fined $1,000.

The railways belonging to the Southwestern Tariff Committee have adopted a rule to require shippers to pay postage on the tariffs sent to them. At a meeting on March 25 the tariff committee of the Missouri Manufacturers' Association of St. Louis decided unanimously to oppose this requirement. E. J. Troy, secretary of the association, in a letter to F. A. Leland, chairman of the Southwestern Tariff Committee, says that the tariff committee of the association feels that the business of the railways should be handled in the same way as any other business and that as the tariffs properly correspond to the catalogues of a commercial concern, they, like catalogues, should be placed in the hands of patrons without cost to them. He says that if the shippers should elect to refuse to pay the charges and should demand quotations of all rates in writing, the expense to the railways of furnishing rates would be much increased.

The curious situation at Albright, Neb., was noticed last week, page 843, when the new tariffs on dressed beef to Chicago were published, Albright, three miles southwest of South Omaha, was by mistake left out. The packers at Omaha have been switching their dressed beef to Albright and consigning it from there in the belief that the old rate of 18½ cents still legally applies from there to Chicago. The road (the Rock Island) contends, however, that the true origin of these shipments is South Omaha and that as the new rate of 23½ cents is published from South Omaha this is the rate that must be collected by the road and be paid by the packers. The higher rate is, therefore, being collected on the shipments from Albright, and in order to get back the difference, if they can legally get it back at all, the packers no doubt will have to sue the railway. Such a suit seems improbable.

Hearing Regarding Rates from New York to the Southwest.

Commissioner Prouty, of the Interstate Commerce Commission, took testimony at Kansas City last week in the proceeding brought by the Southwestern Shippers' Traffic Association for reductions in through freight rates from the Atlantic seaboard via Galveston to points in Kansas, Oklahoma, Texas and Colorado. The competition of the steamship lines from New York to the Gulf ports has caused heavy reductions in the rates to these ports. The complainants allege that by refusing to establish reasonable through rates from the seaboard via the Gulf ports into the interior, the rail carriers from the Gulf have prevented receivers of freight in the interior from obtaining the benefit to which they are entitled from the reductions in the steamship rates to the Gulf ports.

The all-rail rates to points in the section referred to, and also the water-and-rail rates, are based on the rates to the Missouri river. In other words, the rate to Wichita, Kan., is the rate from New York to Kansas City plus the local rate from Kansas City to Wichita. The complainants contend that the rates to points such as Wichita should be based on the rates to the Gulf instead of on the rates to the Missouri river. On the present method of making rates the rate to Wichita is higher than to Kansas City. The adoption of the proposed method would make the rate to Wichita lower than to Kansas City. The complainants argue that the rates to these interior points should be based on Galveston instead of on the Missouri river, because the cost of the service of transporting goods from New York via Galveston to the interior is less than the cost of the service of transporting them from New York to the Missouri river and thence to the interior point. The theory upon which the complainants are proceeding is shown by the following illustration: Oklahoma City is 1,550 miles by all-rail from New York City. The rate at present is based on the all-rail haul. The distance by water from New York to Galveston is 1,800 miles and the distance from Galveston to Oklahoma City is about 600 miles. The complainants

contend that it costs about one-sixth as much to haul goods by water as by rail, which makes the distance by water from New York to Galveston "constructively" 300 rail miles. The addition to this of the rail distance from Galveston to Oklahoma City makes a "constructive" mileage of 900 miles, and the complainants contend that the rates should be based on this constructive mileage. The principal witness for the complainants was J. H. Johnston, manager of the Oklahoma Traffic Association. The hearing will be resumed on April 17, when the railways will introduce their testimony.

Car Surpluses and Shortages.

Arthur Hale, chairman of the committee on relations between railways of the American Railway Association, in presenting statistical bulletin No. 67-A, giving a summary of car shortages and surpluses by groups from November 25, 1908, to March 16, 1910, says:

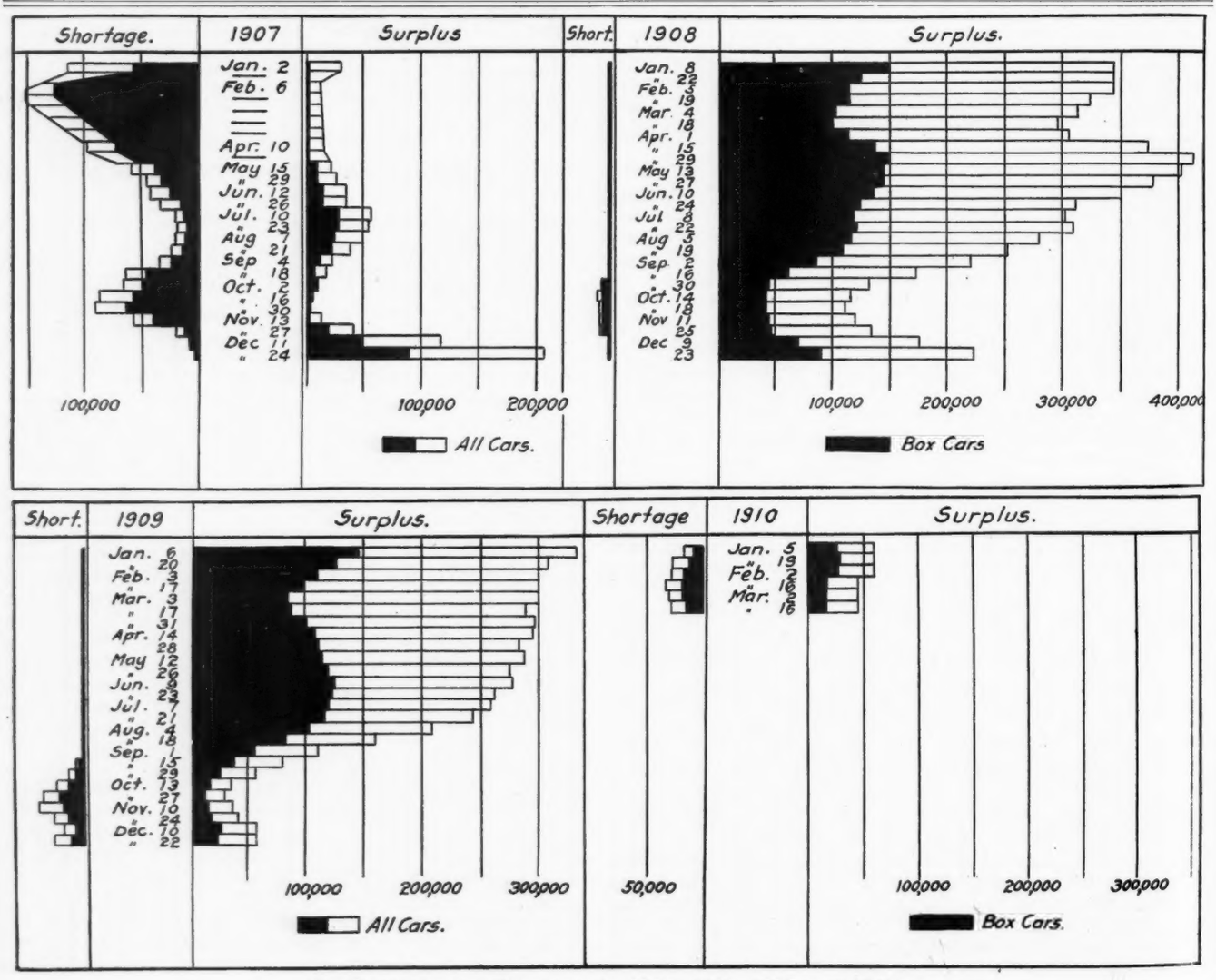
"While the total of surplus cars shows but little change, the class figures indicate some falling off in the use of box cars and an increase in the demand for coal and gondola cars. The increase in box surplus is especially noticeable in group 6 (Northwestern), while groups 4 (South Atlantic) and 5 (Southern), show an increased demand for this class. On the shortage side there is a decrease of 2,720 cars. The box car shortage decreased 3,839 cars, the principal change being in group 6 (Northwestern).

The accompanying table gives surpluses and shortages by groups on March 16, 1910, and the charts show total surpluses and shortages in 1907, 1908, 1909 and 1910.

CAR SURPLUSES AND SHORTAGES.

Date.	Number of roads.	Surpluses. Box.	Flat.	Coal, gondola and hopper.	Other kinds.	Total.	Shortages Box.	Flat.	Coal, gondola and hopper.	Other kinds.	Total.
Group *1—March 16, 1910	8	97	669	566	46	1,378	45	5	31	401	482
" 2— " 16, 1910	22	333	53	1,351	609	2,346	539	517	2,468	23	3,547
" 3— " 16, 1910	22	663	210	160	1,514	2,547	2,060	155	3,266	1,747	7,228
" 4— " 16, 1910	10	973	43	382	621	2,019	3,430	180	2,452	725	6,787
" 5— " 16, 1910	21	682	475	683	656	2,676	2,204	771	893	150	4,018
" 6— " 16, 1910	17	5,851	437	2,199	2,739	11,226	1,822	255	26	617	2,720
" 7— " 16, 1910	4	236	129	328	308	1,001	.....	.....	.....	.....	.....
" 8— " 16, 1910	14	1,150	78	283	1,487	2,998	28	2	4	108	142
" 9— " 16, 1910	10	1,144	320	273	630	2,367	150	.....	.....	624	774
" 10— " 16, 1910	19	3,080	1,058	2,038	4,504	10,680	63	45	1	13	122
" 11— " 16, 1910	7	1,098	2,654	167	1,372	5,291	1,169	.....	.....	198	1,367
Grand total	154	15,487	6,126	8,430	14,486	44,529	11,510	1,930	9,141	4,606	27,187

*Group 1 is composed of New England lines; Group 2—New York, New Jersey, Delaware, Maryland and Eastern Pennsylvania lines; Group 3—Ohio, Indiana, Michigan and Western Pennsylvania lines; Group 4—West Virginia, Virginia, North and South Carolina lines; Group 5—Kentucky, Tennessee, Mississippi, Alabama, Georgia and Florida lines; Group 6—Iowa, Illinois, Wisconsin, Minnesota and North and South Dakota lines; Group 7—Montana, Wyoming and Nebraska lines; Group 8—Kansas, Colorado, Missouri, Arkansas and Oklahoma lines; Group 9—Texas, Louisiana and New Mexico lines; Group 10—Oregon, Idaho, California and Arizona lines; and Group 11—Canadian lines.



Car Surpluses and Shortages in 1907, 1908, 1909 and 1910.

REVENUES AND EXPENSES OF RAILWAYS.

MONTH OF JANUARY, 1910.
(See also issues of March 11, 18, and 25.)

Name of road.	Mileage operated at end of period.	Operating revenues: Freight.	Passenger.	Total, inc. misc.	Operating expenses: Maintenance: Way and structures.	Maintenance: Of equipment.	Traffic.	Transportation.	General.	Total.	Net operating revenues (or deficit).	Outside operations. net.	Taxes.	Operating income (or loss).	Increase (or dec.) comp. with last year.
Alabama & Vicksburg	143	$93,643	$39,352	$143,259	$21,078	$25,065	$4,589	$46,453	$5,151	$102,336	$40,923	.....	$4,350	$36,573	$5,955
Alabama Great Southern	309	249,857	89,144	371,038	46,806	73,335	8,685	109,673	8,379	246,878	124,160	—556	11,236	112,368	31,056
Atlantic & St. Lawrence	167	121,483	16,243	148,058	11,493	17,354	5,433	41,434	4,054	79,768	68,290	.....	6,436	61,854	20,816
Bessemer & Lake Erie	201	211,112	19,069	239,593	42,155	107,077	8,474	111,496	7,946	277,148	—37,555	.....	6,000	—43,555	—41,279
Canadian Pacific in Maine	233	100,976	20,072	128,128	23,962	20,851	4,234	55,546	5,717	110,310	17,818	.....	5,000	12,818	17,578
Carolina, Clinchfield & Ohio	225*	96,728	9,364	108,538	11,532	17,123	5,926	23,715	8,540	66,836	41,702	.....	4,000	37,702	38,168
Central New England	278	178,042	21,814	214,608	39,051	23,753	2,059	79,755	4,375	148,993	65,615	.....	6,500	59,115	15,889
Chicago, Indiana & Southern	341	301,802	17,288	324,911	25,199	55,697	9,514	125,079	8,521	224,010	100,901	11	13,500	87,412	28,682
Chicago, Rock Island & Gulf	529	196,451	62,463	271,247	44,485	25,650	7,751	103,669	8,273	189,828	81,419	—250	8,593	72,576	5,839
Cleveland, Akron & Columbus	212	137,473	34,630	186,024	30,199	40,734	2,329	64,818	4,729	142,809	43,215	.....	5,000	38,215	5,502
Cumberland Valley	162	173,877	41,363	225,928	25,192	29,758	7,031	78,015	5,829	145,825	80,103	691	4,084	76,710	—5,111
Detroit, Grand Haven & Milwaukee	190	98,316	33,488	149,127	19,321	24,520	6,697	76,975	4,412	131,925	17,202	—28	2,727	14,447	—5,522
Evansville & Terre Haute	310	119,546	49,623	187,973	22,092	36,701	5,615	64,735	6,335	135,478	52,495	—849	9,035	42,611	3,673
Georgia Southern & Florida	395	109,540	63,405	205,305	18,802	49,308	5,749	84,194	10,199	168,252	37,053	.....	8,119	28,934	—4,840
Grand Rapids & Indiana	587	244,644	101,803	373,043	51,676	68,760	10,598	185,408	13,698	330,140	42,902	948	24,071	19,779	—16,792
Kanawha & Michigan	175	200,102	21,810	227,138	41,682	63,907	1,903	60,760	4,722	172,974	54,164	—80	6,890	47,194	36,786
Louisiana Ry & Nav. Co.	350	98,064	14,245	124,768	20,065	17,033	4,902	55,589	6,185	103,774	20,994	.....	4,250	16,744	16,604
Louisiana Western	198	107,118	54,412	169,961	21,199	26,673	6,116	50,073	6,438	110,499	59,462	1,066	5,500	55,028	—16,632
Minneapolis, St. Paul & S. S. Marie	2,495†	863,355	267,769	1,193,184	83,601	127,528	28,438	347,912	25,459	612,938	580,246	—339	60,666	519,241	353,076
Missouri Pacific	3,881‡	1,443,433	339,471	1,989,482	347,939	295,505	60,781	917,600	68,395	1,690,220	299,262	—5,735	79,385	214,142	.....
New Orleans & North Eastern	196	211,134	50,257	283,722	27,847	39,914	10,572	99,535	10,973	188,841	94,881	.....	8,700	86,181	—8,262
New Orleans Great Northern	275§	94,907	26,508	128,358	17,248	15,299	2,285	31,229	5,164	71,225	57,133	—78	1,250	55,805	59,601
New York, Philadelphia & Norfolk	112	185,561	27,910	230,068	27,539	39,402	3,389	91,005	8,901	170,236	59,832	.....	6,850	52,982	9,045
New York, Susquehanna & Western	151	130,231	45,456	201,250	18,211	20,702	2,176	95,465	3,472	140,027	61,224	—3,373	11,317	46,534	—20,488
Pecos & Northern Texas	198‡	98,198	18,811	122,259	19,639	19,788	2,264	38,319	4,043	84,053	38,206	.....	2,097	36,109	6,309
Peoria & Eastern	351	198,101	48,872	263,800	20,079	49,893	6,140	101,898	5,289	183,299	80,501	.....	9,200	71,301	43,588
Pittsburgh & Lake Erie	191	1,187,943	110,815	1,335,772	108,035	105,796	13,518	357,502	20,830	605,681	730,091	—426	28,000	701,665	313,196
Rutland	468	117,253	63,524	206,508	20,238	36,081	6,857	93,858	4,493	161,527	44,981	.....	9,083	35,898	6,129
St. Louis, Iron Mountain & Southern	2,610	1,544,218	463,655	2,190,873	302,064	287,145	59,989	798,955	70,049	1,518,202	672,671	—9,066	70,413	593,192	56,070
San Antonio & Aransas Pass	727	224,876	81,884	325,807	56,014	37,510	4,107	125,844	8,989	232,464	93,343	.....	9,000	84,343	51,908
Southern Indiana	236	91,610	12,262	104,646	12,793	21,216	2,004	37,176	5,023	78,212	26,434	.....	6,928	19,506	2,571
Southern Kansas Ry. of Texas	125	83,506	17,112	104,022	13,024	23,601	2,358	42,550	3,697	85,230	18,792	.....	2,325	16,467	—483
Texas Central	268	67,411	28,096	103,335	13,744	11,919	1,526	29,757	3,710	60,656	42,679	.....	2,138	40,541	8,901
Vicksburg, Shreveport & Pacific	171	74,333	36,336	120,523	24,117	22,100	3,494	38,312	4,375	92,398	28,125	.....	6,378	21,747	1,423
West Jersey & Seashore	356	110,449	151,276	286,327	82,943	48,319	9,303	168,527	8,359	317,451	—31,124	—2,561	20,037	—53,722	—8,760
Wisconsin Central	1,030¶	588,296	96,391	718,242	90,272	95,557	23,821	269,405	17,695	496,750	221,492	357	32,071	189,779	96,467
SEVEN MONTHS OF FISCAL YEAR.															
Alabama & Vicksburg	143	$641,219	$291,067	$1,000,115	$154,530	$156,011	$26,307	$304,220	$36,129	$677,197	$322,918	.....	$30,501	$292,417	$87,274
Alabama Great Southern	309	1,550,510	636,793	2,394,993	292,168	560,052	62,162	687,844	61,866	1,664,092	730,901	—$3,549	78,652	648,700	120,074
Atlantic & St. Lawrence	167	576,797	198,016	842,004	228,750	90,466	23,844	252,043	21,643	616,746	225,258	.....	45,049	180,209	58,232
Bessemer & Lake Erie	201	4,650,694	211,328	4,919,824	439,151	750,026	51,582	1,158,289	74,633	2,473,681	2,446,143	.....	75,210	2,370,933	724,101
Canadian Pacific in Maine	233	366,831	147,322	567,738	147,704	92,697	31,933	251,672	22,645	546,651	21,087	.....	35,000	—13,913	—1,944
Carolina, Clinchfield & Ohio	225*	494,746	83,981	596,635	75,904	98,215	34,498	137,223	45,782	391,622	205,013	.....	23,500	181,513	179,558
Central New England	278	1,450,881	210,338	1,750,119	309,797	156,211	11,717	523,292	22,840	1,023,857	726,262	.....	45,500	680,762	202,813
Chicago, Indiana & Southern	341	1,910,924	163,642	2,121,542	317,643	369,332	59,637	707,610	57,158	1,511,380	610,162	400	88,003	522,559	200,165
Chicago, Rock Island & Gulf	529	1,351,098	451,864	1,892,171	315,288	137,343	44,057	666,620	60,468	1,223,776	668,395	—1,760	39,816	626,819	217,064
Cleveland, Akron & Columbus	212	1,052,458	313,058	1,461,237	209,921	365,789	20,198	464,138	26,977	1,087,023	374,214	.....	36,041	338,173	—22,510
Cumberland Valley	162	1,256,411	373,305	1,702,344	226,079	163,054	31,108	496,409	42,199	958,849	743,495	4,068	28,585	718,978	61,777
Detroit, Grand Haven & Milwaukee	190	707,007	358,564	1,219,689	166,762	165,933	41,475	479,868	37,691	891,729	327,960	110	19,091	308,979	62,977
Evansville & Terre Haute	310	964,816	370,761	1,475,595	166,926	212,191	35,491	425,701	46,433	886,742	588,853	—6,347	62,267	520,239	117,396
Georgia Southern & Florida	395	769,781	432,605	1,390,851	142,756	284,630	39,292	497,474	60,909	1,025,061	365,790	6,442	60,828	311,404	41,448
Grand Rapids & Indiana	587	1,775,171	1,066,719	3,041,107	359,238	470,508	77,037	1,182,681	94,006	2,183,470	857,637	—2,120	150,456	705,061	6,500
Kanawha & Michigan	175	1,388,225	193,788	1,613,779	312,219	355,761	15,957	394,531	29,082	1,107,550	506,229	—187	48,333	457,709	199,135
Louisiana Ry & Nav. Co.	350	602,203	112,394	795,349	158,986	93,188	34,015	323,791	38,807	648,787	146,562	.....	27,150	119,412	107,606
Louisiana Western	198	805,736	360,550	1,225,725	123,940	191,670	40,464	333,011	46,882	735,967	489,758	—760	40,638	448,360	—18,660
Minneapolis, St. Paul & S. S. Marie	2,495†	6,836,747	2,260,575	9,568,403	795,565	889,209	170,948	2,565,872	158,304	4,579,898	4,988,505	107,621	545,595	4,550,531	1,482,330
Missouri Pacific	3,881‡	9,346,673	2,390,322	12,940,679	1,965,003	1,911,464	331,708	5,061,922	350,687	9,620,784	3,319,895	—20,998	461,290	2,837,607	.....
New Orleans & North Eastern	196	1,454,038	365,934	1,971,501	200,222	311,480	61,619	665,698	72,999	1,312,018	659,483	.....	57,524	601,959	84,885
New Orleans Great Northern	275§	547,765	208,710	799,825	147,066	110,949	14,938	205,594	33,506	512,053	287,772	—565	6,950	280,257	249,544
New York, Philadelphia & Norfolk	112	1,533,253	242,622	1,905,137	183,735	321,167	24,485	669,250	62,175	1,260,812	644,325	.....	44,350	599,975	135,756
New York, Susquehanna & Western	151	1,010,876	381,594	1,562,540	192,913	150,945	11,033	588,725	26,493	970,109	592,431	—36,996	79,216	476,219	—6,658
Pecos & Northern Texas	198‡	746,936	159,432	942,401	153,736	128,393	12,505	265,374	27,755	587,763	354,638	.....	12,579	342,058	95,877
Peoria & Eastern	351	1,389,360	431,216	1,954,303	211,435	338,097	38,223	672,956	35,595	1,296,307	657,996	.....	60,994	597,002	169,188
Pittsburgh & Lake Erie	191	9,236,260	892,973	10,392,077	954,357	782,561	96,221	2,163,978	143,052	4,140,169	6,251,908	—2,412	126,636	6,122,860	2,510,350
Rutland	468	1,044,380	694,579	1,938,885	273,754	268,991	46,270	686,648	39,291	1,314,954	623,931	.....	70,133	553,798	106,578
St. Louis, Iron Mountain & Southern	2,610	11,164,713	3,179,047	15,564,552	2,228,070	2,125,339	384,532	4,766,953	471,215	9,976,109	5,588,443	—35,035	494,119	5,059,289	713,443
San Antonio & Aransas Pass	727	1,711,183	625,810	2,464,546	360,978	291,783	31,467	886,332	62,100	1,632,660	831,886	.....	63,000	768,886	4,130
Southern Indiana	236	708,595	104,759	824,337	105,231	122,093	15,145	224,297	34,192	500,958	323,379	—836	48,500	274,043	106,959
Southern Kansas Ry. of Texas	125	757,268	140,479	922,146	110,789	150,671	13,077	291,882	25,437	591,856	330,290	.....	13,152	317,138	183,259
Texas Central	268	382,325	226,598	658,379	117,014	88,547	11,341	200,257	26,941	444,100	214,279	.....	20,251	194,028	—66,161
Vicksburg, Shreveport & Pacific	171	499,769	292,913	858,319	150,982	155,360	23,682	245,142	30,348	605,514	252,805	.....	46,118	206,687	31,091
West Jersey & Seashore	356	974,776	2,246,827	3,454,621	562,301	396,362	101,510	1,357,240	59,831	2,477,244	977,377	13,767	140,260	850,884	103,490
Wisconsin Central	1,030¶	3,737,398	935,496	4,962,576	652,902	677,744	160,925	1,681,667	115,737	3,288,975	1,673,601	5,146	205,553	1,473,195	168,921

* Mileage operated on January 31, 1909, 145. † Mileage operated on January 31, 1909, 2,395. ‡ Consolidated company; began operations on August 9, 1909. § Mileage operated on January 31, 1909, 91. ‡ Mileage operated on January 31, 1909, 152. ¶ Mileage operated on January 31, 1909, 1,131. — Indicates Deficits, Losses and Decreases.

Union Pacific Merger Hearing.

On Monday of this week Edwin Hawley testified at New York in the suit of the government to annul the practical merger of the Union and the Southern Pacific. He testified that he was associated with C. P. Huntington of the Southern Pacific for twenty years; that he was in close touch with Mr. Huntington for several pears prior to the latter's death, seeing him every day; that he accompanied Messrs. Huntington and Harriman on a trip into the Adirondacks when Mr. Harriman was negotiating for the control of the Southern Pacific, and that he never knew of Mr. Harriman's making an effort to secure the Central Pacific as a separate property. Shortly before Mr. Huntington's death Mr. Hawley joined with him in the purchase of 100,000 shares of Southern Pacific stock from the Crocker estate; and after Mr. Huntington's death Mr. Hawley negotiated the sale of the Southern Pacific stock of the Huntington estate to Mr. Harriman, this stock consisting of 475,000 shares, including Mr. Hawley's own holdings, which amounted to about one-fourth.

Mr. Hawley fixed the price at which this stock was sold. This was in February, 1901. He had never been approached by Mr. Gould regarding the sale of this stock. He received authority to sell the Huntington estate stock from Mrs. Huntington.

INTERSTATE COMMERCE COMMISSION.

Shipper's Mistake in Misrouting.

P. P. Donahue v. Chicago, Milwaukee & St. Paul et al. Opinion by Chairman Knapp.

Reparation denied. (18 I. C. C., 92.)

Increase in Minimum Carload Rate Reasonable.

E. T. Barnum Iron Works v. Cleveland, Cincinnati, Chicago & St. Louis et al. Opinion by Commissioner Clements.

Complaint dismissed. (18 I. C. C., 94.)

Carload Rate on Salt from West Virginia South Unreasonable

Liverpool Salt & Coal Co. et al. v. Baltimore & Ohio et al. Dixie Salt Works v. same. Opinion by Commissioner Clements.

Maximum rate prescribed. (18 I. C. C., 51.)

Unreasonable Rate Charged.

George Tritch Hardware Co. v. Chicago, Rock Island & Pacific. Opinion by Commissioner Harlan.

Reparation awarded on one shipment of agricultural implements from Omaha, Neb., to Denver, Colo. (18 I. C. C., 71.)

Refund of Demurrage Charges Denied.

Germain Co. v. Philadelphia, Baltimore & Washington et al. Opinion by Commissioner Clements.

Complaint dismissed. (18 I. C. C., 96.)

Failure to Furnish Large Car Condemned.

Maldonado & Co. v. Ferrocarril de Sonora et al. Opinion by Commissioner Harlan.

Reparation for overcharge awarded. (18 I. C. C., 65.)

Wood-Pulp Board Shipments.

Wabash Coating Mills v. Wabash Railroad et al. Opinion by Chairman Knapp.

Reparation on shipments from Wabash, Ind., to St. Louis, Mo., denied. (18 I. C. C., 91.)

Rate on Egg Case Material Unreasonable.

Anderson-Tully Co. v. Chicago, Rock Island & Pacific et al. Opinion by Commissioner Cockrell.

Rate from Tennessee to Oklahoma for future established. Reparation awarded. (18 I. C. C., 48.)

Class Rates from Albuquerque to El Paso.

Crombie & Co. et al. v. Atchison, Topeka & Santa Fe.

Complaint dismissed and case referred to informal docket for the adjustment of reparation. (18 I. C. C., 57.)

Rate on Coal Unreasonable.

Rainey & Rogers v. St. Louis & San Francisco. Opinion by Chairman Knapp.

Rate on coal from Carbon Hill district, Ala., to New Albany, Miss., reduced from $1.10 per ton to 95 cents per ton. (18 I. C. C., 88.)

Rates on Canned Goods Unreasonable.

Stone-Ordean-Wells Co. v. Southern Pacific et al.—Opinion by Commissioner Prouty.

Reparation awarded on shipments from California to Montana. (18 I. C. C., 13.)

Shipments from California Points to Alturas, Cal.

E. Lauer & Son v. Southern Pacific et al. Opinion by Chairman Knapp.

Reparation on interstate shipments of hardware and other commodities denied. (18 I. C. C., 109.)

REVENUES AND EXPENSES OF EXPRESS COMPANIES.

FOR THE MONTH OF NOVEMBER, 1909.

Name of company.	Adams Express.	American Express.	Canadian Express.	Can. Nor. Express.	Globe Express.	Great Nor. Express.	National Express.	Northern Express.	Pacific Express.	Southern Express.	United States Express.	Wells, Fargo & Co.	Western Express
Mileage of all lines covered: Rail lines	30,958	46,267	7,078	3,164	1,900	7,232	1,094	6,497	22,171	30,691	23,921	56,518	3,452
Other lines	3,488	1,321	2,792	22	.....	211	292	261	608	2,995	611	5,189	4
Operating revenues:													
Express	$2,825,476	$3,029,214	$207,941	$35,103	$48,269	$217,164	$92,122	$284,870	$744,069	1,214,753	$1,402,725	$2,473,868	$65,453
Misc. transportation	.....	.....	.....	.....	.....	.....	.....	.....	1	.....	.....	141	199
Nontransportation	17,472	100,479	4,890	2,226	478	1,278	492	5,242	11,790	15,379	23,432	46,191	984
T'l receipts operation	2,842,948	3,129,693	212,831	37,329	48,747	218,442	92,614	290,112	755,861	1,230,132	1,426,157	2,520,200	66,636
Exprs. privileges—Dr.	1,478,291	1,428,255	100,428	13,673	24,127	87,940	33,694	140,308	361,851	580,901	649,512	1,204,949	25,169
Total	$1,364,656	$1,701,438	$112,403	$23,656	$24,620	$130,502	$58,920	$149,804	$394,009	$649,231	$776,645	$1,315,251	$41,468
Operating expenses:													
Maintenance	$73,849	$81,589	$1,635	$195	$314	$1,582	$444	$1,401	$12,341	$19,612	$32,252	$51,615	$436
Traffic	6,315	17,805	953	114	1,673	809	.....	3,467	6,061	6,378	13,526	16,600	909
Transportation	931,995	1,170,253	84,729	10,039	15,133	49,952	45,357	73,175	223,413	371,193	595,289	841,642	21,682
General	84,384	101,163	7,080	1,366	2,598	3,177	2,828	3,569	13,248	44,470	44,736	74,128	1,726
Total	$1,096,543	$1,370,810	$94,398	$11,714	$19,719	$55,520	$48,629	$81,612	$255,062	$441,653	$685,804	$983,985	$24,752
Net operat'g rev. or def.	$268,114	$330,628	$18,005	$11,942	$4,901	$74,982	$10,291	$68,192	$138,947	$207,578	$90,841	$331,266	$16,716
Taxes	14,097	16,744	1,150	130	550	2,792	215	3,500	4,948	10,036	6,194	15,659	462
Operating inc. or loss.	$254,017	$313,884	$16,855	$11,811	$4,351	$72,190	$10,076	$64,692	$134,000	$197,542	$84,648	$315,607	$16,254

Hardwood Lumber Shipments from Memphis to New Orleans.

J. W. Thompson Lumber Co. et al. v. Illinois Central et al. Opinion by Commissioner Lane.

Reparation awarded on basis of original report of the commission in case 13 I. C. C., 657. (18 I. C. C., 83.)

Rates on Fertilizer from Memphis, Tenn., Unreasonable.

Virginia-Carolina Chemical Co. v. St. Louis, Iron Mountain & Southern et al. Opinion by Commissioner Prouty.

Case retained for further proceedings. (18 I. C. C., 1.)

Virginia-Carolina Chemical Co. v. Chicago, Rock Island & Pacific. Opinion by Commissioner Prouty.

Case retained for further proceedings. (18 I. C. C., 3.)

Virginia-Carolina Chemical Co. v. St. Louis & San Francisco. Opinion by Commissioner Prouty.

Case retained for further proceedings. (18 I. C. C., 5.)

Increased Rate Reduced.

Commercial Club of Omaha v. Southern Pacific et al. Opinion by Commissioner Harlan.

Without renewing the discussion of the question, fully considered in other cases, as to which side has the burden of proof in a proceeding attacking the reasonableness of an increased rate, it is clear that an order granting affirmative relief, and particularly in a case in which reparation is awarded, must be predicated on a definite conviction drawn from the record or from the commission's own investigation, or from both, that the rate exacted on the shipments complained of was an unreasonable rate.

Defendants' prior rate of 85 cents per 100 lbs. for the transportation of lima beans in carloads from certain points in California to Omaha, Neb., found unreasonable, and their subsequently established 75-cent rate prescribed for the future. Reparation awarded. (18 I. C. C., 53.)

Use of Mileage Books Discussed.

Bernard Eschner v. Pennsylvania Railroad et al. Opinion by Commissioner Harlan.

Defendants' published tariffs prohibit the use of an exchange order in connection with an ordinary mileage book as a warrant for checking the holder's baggage or securing through sleeping accommodations from any point on the Pennsylvania Lines West of Pittsburgh to a point on said lines east thereof, or *vice versa*. On complaint that such a provision in the tariffs is unreasonable and discriminatory, held that the right to use exchange orders and mileage books is in the nature of a privilege voluntarily accorded by carriers under their tariffs, and must be accepted by those who use such special fares with all lawful and non-discriminatory limitations that may be attached to them.

The language of the act relating to the issuance of mileage, excursion and commutation tickets is altogether permissive, and the commission has no affirmative power to require carriers to establish, for the use of passengers on particular occasions or for special purposes, special fares based on less than a normal passenger-mile revenue. (18 I. C. C., 60.)

Informal Complaint Is Cause of Action.

Memphis Freight Bureau v. St. Louis Southwestern. Opinion by Commissioner Harlan.

The rules of the commission, while not overlooking the definite requirements of the law, were intended to relieve complainants from the observance of the technical rules of pleading in order that shippers unskilled in such matters might bring their troubles to us in their own proper persons.

An informal complaint showing the date of the shipment, its actual weight, the rate charged and collected, and all other facts necessary to identify it, coupled with the claim that there was an overcharge on the shipment in that the carrier applied a 10-cent rate instead of a 6-cent rate is a sufficient presentation or filing of the claim to stop the running of the limitation of actions provided in section 16 of the act. Such an informal complaint sufficiently alleges a violation of the act and therefore sets up a cause of action as in that section provided. A rate of 10 cents per 100 lbs. on cotton-seed meal and hulls formerly published by the defendant from Little Rock, Ark., and Pine Bluff, and Memphis, Tenn., declared unreasonable and reparation awarded. (18 I. C. C., 67.)

Rates on Cement Plaster Reduced.

Acme Cement Plaster Co. v. Chicago & North Western et al. Opinion by Commissioner Prouty.

Rates on cement plaster in C. L. lots from Norfolk, Neb., to various points on the Niobrara branch of the C. & N. W. found unreasonable and reasonable rates prescribed for the future. Reparation denied.

Commissioner Harlan dissenting:

The complaint, as well as the report of the commission, proceed on the theory that when the through charges on a commodity moving between interstate points are attacked as unreasonable, it is sufficient to prove that part of the through charge is unreasonable. The defendant claimed that the total cost of through transportation was reasonable and the complainant insists that the question involved is really whether the amount charged by that defendant (Chicago & North Western) for its part of the through haul is unreasonable or not. When closely analyzed the report of the majority seems to proceed on that theory. In my judgment the rates referred to in the report, most of which are rates between points in the same state, are not properly the subject of an order except by showing that the through charges are themselves unreasonable, and no such showing was pretended to be made. (18 I. C. C., 105.)

Flour Rate from Minneapolis to New York Reduced.

W. J. Jennison Co. et al. v. Great Northern et al. Opinion by Commissioner Clark.

This case was originally submitted to the commission for decision on June 3, 1909, but the case was reopened and further testimony was taken at Buffalo, N. Y., in January, 1910. Complainants operate mills with a daily capacity of about 125,000 barrels of flour. The defendants include all the rail and water carriers engaged in transportation of flour from Minneapolis and Duluth to the Atlantic seaboard. Flour moves from Minneapolis to the Atlantic seaboard under joint through rates. Wheat moving lake and rail to the seaboard does not move under joint through rates.

The rate on flour rail-lake-and-rail from Minneapolis to New York via Duluth is 23 cents per 100 lbs.; from Duluth to New York, lake-and-rail, it is 18 cents per 100 lbs.; all-rail from Minneapolis, it is 25 cents per 100 lbs., and all-rail from Duluth, it is 25 cents per 100 lbs. The all-rail rate on wheat from Minneapolis to New York is 26 cents per 100 lbs., and from Duluth 26 cents per 100 lbs. The rail rate on flour from Buffalo to New York is 10 cents per 100 lbs. The local rate on wheat from Buffalo to New York is 10 cents per 100 lbs. and the ex-lake rate, which also includes elevation, is 10.83 cents per 100 lbs.

The complaint is that defendants discriminate against Minneapolis in favor of millers at Buffalo, in that the transportation charges on the mill products from the mill points in the Northwest to the Atlantic seaboard are unduly high as compared with the charges for the transportation of the wheat from the same territory to Buffalo, plus the transportation of the milled product from Buffalo to the Atlantic seaboard. Complaint is also made that the rail-lake-and-rail rate of 23 cents per 100 lbs. is unreasonable *per se*.

Mills located at Buffalo grind large quantities of the Minnesota and Dakota wheat, which is brought to Buffalo by water carriers on the Great Lakes. The mill products manufactured at Buffalo are marketed principally in the state of New York, in northern Pennsylvania and in the states east thereof. The Buffalo millers export but little flour. It appears that the Minneapolis millers market more or less of their product in the Northwest, large quantities in the Middle West, and that they send large quantities to the Atlantic seaboard and New England. It is shown that since 1902 the total output of

Minneapolis mills has decreased and the receipts of wheat at Buffalo have increased.

In comparing the transportation charges on wheat and on flour, both must be computed from Minneapolis, as the Minneapolis flour rate is the one attacked. The commercial profits of the Minneapolis and Buffalo millers would be computed on another basis, and are neither controlling nor important here. The charges paid by them, respectively, for transportation services are about as follows: The Minneapolis miller pays 23 cents per 100 lbs., or 46 cents per barrel of flour from Minneapolis to New York. The Buffalo miller ships from Duluth to Buffalo 270 lbs. of wheat from which to make a barrel of flour, and on that he pays 9.45 cents for transportation and 4.32 cents for elevation. He pays 20 cents for transporting his barrel of flour from Buffalo to New York, and has therefore paid total charges 33.77 cents, which includes the freight to Buffalo on 70 lbs. of by-product, amounting to 2.45 cents. Insurance, storage, switching, cleaning, etc., might change these figures slightly, but apparently such charges are common to both and about equal.

As has been seen, the lowest rate on flour from Minneapolis to New York is via Duluth and is 5 cents per 100 lbs. higher than the rate from Duluth. It is therefore seen that in spite of a differential of 5 cents per 100 lbs. against the Minneapolis miller as compared with the Duluth miller, Minneapolis has been and still is the greatest flour-milling center in the country. It also appears that the milling industry at Duluth has been declining.

We therefore have this situation: For a number of years prior to 1898 the regular or package lines of boats on the lakes were independent of the railways and a well-recognized and established differential of 5 cents under the all-rail rate existed via rail-lake-and-rail. The railways gradually absorbed the lake lines and in 1898 they increased the rail-lake-and-rail rate on flour 2 cents per 100 lbs. and in 1902 increased this rate another cent. It is conceded that the defendant railways own or control all of the boat lines that transport flour from Duluth to Buffalo. These boats also engage in the transportation of wheat. At some seasons of the year the rate on wheat is made by the tramp boats and at other seasons by the regular line boats. The records of the Duluth Board of Trade and of the United States Government and the testimony in the case establish the fact that the average rate for transporting wheat by water from Duluth to Buffalo is not in excess of 3.5 cents per 100 lbs. It is admitted that this is a profitable rate. It costs less to carry wheat than to carry flour on the lakes. Independent boats that were originally built and fitted to engage in package freight business are unable to secure and engage in that business because defendants control the terminals and wharves and refuse to permit independent boats to load or unload [flour] thereat and refuse to receive packages from independent boats.

This record shows that subsequent to the increase in rail-lake-and-rail flour rates in 1898 and in 1902, and prior to August 28, 1906, the effective date of the amended act, the actual rate paid on flour from Minneapolis to New York rail-lake-and-rail did not exceed 20 cents per 100 lbs.

The rate on flour rail-lake-and-rail from Minneapolis to New York is 23 cents per 100 lbs. This rate is divided, as we understand, 5.8 cents Minneapolis to Duluth, 7.6 cents Duluth to Buffalo, and 9.6 cents Buffalo to New York. The transportation charges on wheat from Minneapolis to Buffalo are in the average, including elevation, just about 10 cents per 100 lbs., divided 5 cents Minneapolis to Duluth, 3.5 cents Duluth to Buffalo, and the remainder for elevation, and the rate on flour from Buffalo to New York is 10 cents per 100 lbs. There is therefore a difference of 3 cents per 100 lbs. in these transportation charges to the disadvantage of the Minneapolis miller.

The charge for transportation of wheat rail-lake-and-rail from Minneapolis to New York, using the existing ex-lake rate from Buffalo of 10.83 cents per 100 lbs., and inciuding cost of elevation is a little less than 21 cents per 100 lbs. The additional costs to the Buffalo miller for handling wheat at Buffalo seem to be common to the milling business and to be substantially the same as and offset by similar costs borne by the Minneapolis millers and not figured in as transportation cost. The difference in profits and ability to sell in common markets as between the Buffalo miller and the Minneapolis miller must be purely commercial questions, in so far as they go beyond the above-outlined difference in transportation costs.

From Minneapolis to Duluth the rates on wheat, 5 cents, and on flour, 5.8 cents, are substantially on a parity. The same is substantially true as to the rates from Buffalo to New York, where we find the local rate on flour 10 cents, the division of the all-rail rate from Minneapolis 9.6 cents, the local rate on wheat 10 cents, and the ex-lake rate on wheat 10.83 cents. This ex-lake rate includes, as has been seen, some costs of elevation, etc. It has somewhat recently been raised above the level at which it stood for a long time, and at its present level is particularly objected to by the Chicago interests. It is, however, on substantial parity with the rate on flour which, in the *Banner Miller Co.* case, we found to be reasonable, and nothing now presented persuades us that that finding should be changed. From Duluth to Buffalo, however, the rates and charges are not nearly or substantially on a parity. The charge on wheat is 3.5 cents and on flour 7.6 cents. It appears that 2 cents per 100 lbs. fully compensates for the additional cost of transporting flour as compared with wheat, but here we find an additional charge of 4 cents.

These proportional rates and divisions of rates are not taken by us as conclusive in determining the reasonableness of either local or joint through rates. They are, however, highly illustrative and emphasize the conclusion that is reached by other tests.

The rate complained of, 23 cents per 100 lbs. on flour via rail-lake-and-rail from Minneapolis to New York and other Atlantic seaboard points taking the same rate, is unreasonable in so far as it exceeds 21½ cents per 100 lbs. We find that for the future that rate should not exceed 21½ cents per 100 lbs., and such an order will be entered.

Discrimination Against Des Moines.

Greater Des Moines Committee v. Chicago, Milwaukee & St. Paul. Opinion by Commissioner Cockrell.

Complaint asks that rates from Des Moines, Iowa, to western Minnesota and North and South Dakota be readjusted and made on a mileage and percentage basis of the rates from Chicago to those points. Complaint attempts to show that Des Moines is discriminated against, because rates from there are relatively higher to Minnesota and to North and South Dakota points than from Chicago and points based on Chicago. The commission finds that Des Moines, although the largest city in Iowa, is not materially differently situated, as regards trade, from a number of other interior Iowa points. The interests of these localities were not represented at the hearings, and in passing on so important a matter the commission is bound to consider the whole field. It is held that the facts shown are not sufficient to justify a change in present rate adjustment.

Commissioner Lane dissenting:

I hold that we should not dismiss a complaint because a complainant has not made out a case. The burden of proving the case is not on the complainant. When a proceeding is brought before this commission, after complaint is made the burden is on the commission to make such investigation as may be necessary in the public interest. Examinations into various complaints brought before this commission by the Greater Des Moines Committee satisfy me that the rate adjustment between the cities in the territory between the Mississippi and Missouri rivers, and the cities of Chicago, St. Louis, Kansas City, Omaha and similarly situated points, is not fair. There will be no harmony between carriers and shippers in Iowa and west thereof until some system similar to that prevailing in official classification territory is adopted. Discrimination between individuals has been largely destroyed. The problem now before the commission is to investigate and destroy discriminations between places. Burnham-Hanna-Munger case 14 I. C. C., 299, cited. I favor the retention of this complaint as a basis for exhaustive investigation that will lead to an effective order. (18 I. C. C., 73.)

Greater Des Moines Committee v. Chicago Great Western et al. Opinion by Commissioner Cockrell.

Complaint claiming discrimination against Des Moines in favor of St. Joseph and other cities dismissed because not sustained by the facts presented. (18 I. C. C., 98.)

STATE COMMISSIONS.

The Louisiana Railway Commission has fixed a maximum intrastate charge of 35 cents for the transportation of samples of sugar, rice, molasses and coffee.

The Georgia State Railroad Commission has modified its order requiring railways to report all accidents, and will not compel the roads to give the names of persons injured.

The Railroad Commission of Louisiana holds that the rule proposed by telegraph companies, limiting the number of letters in unpronounceable combinations of letters to five, and counting as one word each five letters or fraction thereof, is not unreasonable.

The Louisiana Railway Commission has fixed a rate of one-half the regular tariff rate for all shipments of second-hand machinery which has been repaired and returned to the original owner or which is to be purchased from the original owner for the purpose of being reconstructed by the purchaser for manufacturing purposes in Louisiana. A minimum carload weight of 40,000 lbs. is fixed.

The State Railway Commission of South Carolina has ordered the Charleston & Western Carolina to run an additional daily passenger train between Yemassee and Robbins, 59 miles. This order was issued on petitions from citizens of a number of towns along the line, and it will result in double daily service from Yemassee to Augusta, Ga., as from Robbins to Augusta there are already two daily trains.

The Indiana Railroad Commission has prepared a circular letter to be sent to all the railways in the state, accompanied by a blue-print, calling attention to the order that all unprotected highway crossings, outside of incorporated towns and cities, shall be equipped with sign posts bearing the words "Railroad Crossing" and "Danger," the latter word to be painted in red. Where there is a double crossing the commission is particular in directing that the words "Two Crossings" shall appear. The blue-print sent with the letter shows types of signs approved by the commission. The signs have the customary crossed arms with the word railroad on one arm and crossing on the other. In addition there is a horizontal arm below the cross having the word danger painted on it in red.

Wisconsin: Spur Track Ordered.

Hickerson Roller Mill Co. v. Northern Pacific.

Petition alleges that the respondent railway company refuses to repair a certain spur track leading from respondent's main line to petitioner's mill, and prays that an order issue ordering respondent to make such repairs. Where there is no private contractual limitation upon the use of a spur track by the railway constructing it, the same becomes a part of its railway system and must be maintained and operated accordingly for the benefit of any and all persons who may require the services thereof. That the respondent in the instant case acquired the right of way without restriction as to its use and constructed, maintained and operated the spur track for public purposes.

Louisiana Express Rates from Shreveport.

Shreveport Traffic Association v. The Pacific Express Co., Wells, Fargo & Co. Express, The Southern Express Co.

The commission holds that the rates from Shreveport to points in Louisiana for express matter should not exceed rates for similar distances for the same service as apply from Monroe, and that the present rates from Shrevepert are discriminative. The following rates from Shreveport are ordered:

Distances.	Rate per 100 lbs.
20 miles and less	$0.40
30 miles and over 20	.45
50 " " " 30	.50
70 " " " 50	.60
100 " " " 70	.75
120 " " " 100	.80
150 " " " 120	.90
175 " " " 150	1.00
Over 175 miles	1.25

COURT NEWS.

The United States circuit court of appeals at St. Louis has rendered a decision holding that the federal 28-hour law cannot be applied to a terminal railway unless the terminal railway causes on its own tracks the entire delay to a shipment of live stock which results in infraction of the law. The decision was rendered in a case brought against the Stock Yards Terminal Company of St. Paul, Minn. The delivering railway had pleaded guilty to a charge of keeping live stock in transit without food and water more than 28 hours and was fined. The government sought to collect an additional penalty from the terminal company.

The supreme court of Texas has rendered an opinion holding that under the laws of that state railways must obey routing instructions of shippers when given to them in writing. The decision was rendered in the case of James A. Thompson versus the Missouri, Kansas & Texas. Thompson bought some lumber from the Thompson-Tucker Lumber Company at Willard, a point on the line of the Katy where there is no agent, and gave the conductor bills of lading containing directions that the goods be so transported to Taylor, Tex., as to give the International & Great Northern the long haul. The conductor accepted the bills of lading but erased the shipper's instructions and so routed the shipment as to give the M., K. & T. the long haul. The court said that one mind cannot make a contract, and, therefore, there was no contract between Thompson and the railway, but a high-handed disregard of his legal rights and a forcible taking and carrying of his property according to the railway's wishes without consent on his part, but to serve its unlawful purpose. Thompson had no choice, the court said, but to receive the cars when they reached Taylor, and, therefore, his doing so did not in any way ratify the unlawful act of the defendant. He was awarded damages.

An injunction forbidding the Boston & Maine to charge or collect the present scheduled freight rates was issued in the superior court of New Hampshire March 26 by Judge William A. Plummer. The injunction is based on the claims that the greater part of the Boston & Maine mileage in New Hampshire consists of leased lines; that these leased lines were chartered by New Hampshire legislatures with the conditions specified that they should be subject to New Hampshire laws and state authorities; that they were leased in accordance with special permissions from New Hampshire legislatures, and that these permissions were granted with special provisos that the freight rates should not be raised without permission from the legislature, and that they have been raised without such permission. The matter has been before the State Railroad Commission, but that body has come to no conclusion. The railway attorneys put up a blanket defense, claiming compliance with the spirit of the law, and that if it should be technically found that the railway has not complied with the precise letter of the law that any action is barred by the statute of limitations. The present equity suit is brought as an expeditious means of bringing the case to a final decision from the state supreme court. The case is brought in the name of the state by Attorney-General Eastman in his home county of Rockingham. The superior court hearing on the question of making the injunction permanent is ordered for the term to be held at Exeter beginning Tuesday, April 19.

FOREIGN RAILWAY NOTES.

The promoters of the Dairen-Laohutan light railway have asked for a franchise and propose to spend $25,000 in installing a line. They agree to make 10 trips a day each way and to provide cars with a capacity of seating 30 passengers. From 4.5 to 10-ton locomotives will be used.

In 1906 a section of track in Prussia was laid on 1,000 beech ties preserved with a mixture of tar oil and chloride of zinc. Down to a recent date 74.7 per cent. of these had been removed because of decay, while on an adjacent section where at the same time track was laid on 3,000 similar ties preserved with tar oil alone, not one had required renewal. The Prussian railway authorities call for other observations of the effect of different methods of treating ties.

Railway Officers.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

E. W. Beatty has been appointed general solicitor of the Canadian Pacific, with office at Montreal, Quebec.

J. F. Collins has been elected President of the Toledo & Western, with office at Sylvania, Ohio, succeeding C. F. Franklin.

Maurice H. Thatcher, of Kentucky, has been appointed, subject to confirmation by Congress, a member of the Isthmian Canal Commission.

Ray Morris, comptroller of the Gulf Line Railway, has resigned to enter other business. E. K. Gullen, traveling auditor of the Norfolk & Southern, becomes auditor of the Gulf Line Railway April 1.

F. L. Maytag, first vice-president of the South Dakota Central, at Newton, Iowa, has been elected president, succeeding P. F. Sherman, resigned. Joe Kirby has been elected First Vice-President, succeeding Mr. Maytag, and G. W. McArthur has been elected Second Vice-President and General Manager, all with office at Sioux Falls, S. D.

Operating Officers.

L. M. Olliges has been appointed assistant trainmaster of the Missouri, Oklahoma & Gulf, with office at Muskogee, Okla.

J. S. Douglas has been appointed an Assistant Trainmaster on the Missouri Pacific-Iron Mountain system, with office at Scott City, Kan.

F. I. Cummins, traffic manager of the South Dakota Central at Sioux Falls, S. Dak., has been appointed also general superintendent, with office at Sioux Falls.

B. J. Fallon, engineer maintenance of way of the Metropolitan West Side Elevated Railway at Chicago, has been appointed assistant general manager, with office at Chicago.

E. D. Winslow has been appointed superintendent of telegraph of the Chicago, Rock Island & Gulf, with office at Ft. Worth, Tex., succeeding A. B. Crowley, assigned to other duties.

L. E. Beilstein has been appointed General Manager of the Toledo & Western, with offices at Sylvania, Ohio, succeeding C. F. Franklin. W. E. Pierce has been appointed Superintendent, with office at Sylvania.

F. O. Whiteman, Trainmaster of sub-divisions 46 and 47 on the Louisiana division of the Rock Island Lines, has had his jurisdiction extended over sub-divisions 45 and 45a, with office at Eldorado, Ark., succeeding J. P. Quigley, resigned.

J. J. Mahoney, assistant superintendent of the Chicago & Alton at Bloomington, Ill., has been appointed superintendent of transportation of the Atchison, Topeka & Santa Fe, with office at Newton, Kan. The office of assistant superintendent of the Alton at Bloomington has been abolished.

G. H. Groce, Assistant to the General Manager of the Illinois Central and the Indianapolis Southern, with office at Chicago, having resigned to go with the General Railway Signal Company at Rochester, N. Y., the position of Assistant to the General Manager has been abolished. The Superintendents of telegraph will report to the Assistant to the Vice-President and the Signal Engineer will report to the Chief Engineer.

Joseph Fortin, whose appointment as superintendent of the Quebec Central, with office at Sherbrooke, Que., has been announced in these columns, was born December 29, 1859, at St. Aubert, L'Islet county, Quebec. He attended Levis college in 1878, and began railway work on February 14, 1882, on the Quebec Central. In 1886 he was appointed agent and representative of that company, and later was made acting superintendent, which position he held at the time of his recent appointment.

Traffic Officers.

A. M. Dudley has been appointed Agent of the Kanawha Despatch, with office at St. Joseph, Mo.

H. R. Carl has been appointed a traveling freight agent of the Great Northern, with office at St. Paul, Minn.

J. J. Carey has been appointed a traveling passenger agent of the Erie, with office at San Francisco, Cal., succeeding A. H. Moffitt, resigned.

W. H. Askew has been appointed a traveling freight and passenger agent of the New Orleans, Mobile & Chicago, with office at Laurel, Miss.

C. B. Fiske, division freight agent of the Chicago Great Western, with office at Fort Dodge, Iowa, has resigned to engage in other business.

W. T. Robson, advertising agent of the Canadian Pacific at Montreal, Que., has been appointed general advertising agent, with office at Montreal.

George H. Martin, District Passenger Agent of the Iowa Central and the Minneapolis & St. Louis, with office at Oskaloosa, Iowa, has resigned to engage in other business.

C. A. Lahey has been appointed chief of the tariff bureau of the Chicago, Milwaukee & St. Paul, with office at Chicago, succeeding B. F. Bayha, resigned to accept service elsewhere.

Geo. B. Ogden has been appointed a traveling freight agent of the Great Northern, with office at Buffalo, N. Y., succeeding Wm. F. Morris, Jr., resigned to engage in other business.

E. W. Rice, General Agent of the American Refrigerator Transit Company at Tyler, Tex., has been appointed General Freight Agent, with office at St. Louis, Mo., succeeding H. H. Purcell, deceased.

D. M. Newton, City Passenger Agent of the Oregon Short Line at Salt Lake City, Utah, has been appointed a Traveling passenger agent, with office at Ogden, Utah, succeeding A. B. Moseley, resigned to engage in other business.

A. J. Lee, city passenger and ticket agent of the Southern Railway at Mobile, Ala., has been appointed district passenger agent, with office at New Orleans, La., succeeding J. C. Andrews, southwestern passenger agent, retired.

T. J. Smith has been appointed general freight agent of the Canadian Pacific, with office at London, England, succeeding H. D. Annable. F. W. Forster, agent at Bristol, has been appointed agent at Liverpool, succeeding J. J. Gilbertson. A. S. Ray succeeds Mr. Forster.

R. A. Taylor has been appointed freight claim agent of the Galveston, Harrisburg & San Antonio, the Houston & Texas Central, the Houston East & West Texas and the Houston & Shreveport, with office at Houston, Tex., succeeding A. A. Martin, resigned to accept service elsewhere.

Harry C. Howe, agent at the terminal interchange station of the Chicago & North Western at Chicago, has been appointed freight claim agent, with office at Chicago, succeeding to part of the duties of R. C. Richards, general claim agent, to whom he will report. Mr. Richards continues as general claim agent and will hereafter give special attention to matters pertaining to personal injuries and damage to property other than freight.

Engineering and Rolling Stock Officers.

James Walker, consulting engineer of the Metropolitan West Side Elevated Railway at Chicago, has been appointed chief engineer, with office at Chicago.

The office of Roadmaster of the Rock Island Line at Lecompte, La., has been abolished. M. J. Farrell has been appointed Roadmaster between Eldorado, Ark., and Eunice, La.

R. P. C. Sanderson, superintendent of motive power of the Virginian Railway at Norfolk, Va., has resigned to become general superintendent of the new works of the Baldwin Locomotive Works at Eddystone, Pa.

T. H. Hamill, roadmaster of the National Railways of Mexico at Torreon, Coahuila, Mex., has been appointed resident engineer in charge of betterments and additions on the Northern division, with office at Monterey, Mex.

J. F. Deems, general superintendent of motive power, rolling stock and machinery, of the New York Central Lines, with office at New York, has had his authority extended over the Toledo & Ohio Central and the Zanesville & Western.

C. M. Tritsch, recently appointed superintendent of motive power and car departments of the Western Maryland, with office at Hagerstown, Md., has been appointed also to the same position on the Georges Creek & Cumberland Railroad.

E. W. Pratt, assistant superintendent of motive power and

machinery of the Chicago & North Western, at Chicago, has been transferred to Clinton, Iowa. F. S. Fosdick, master mechanic at Mason City, Iowa, has been transferred to Chicago, succeeding E. H. Wade. J. Charlton, master mechanic at Chicago Terminals, Chicago, succeeds Mr. Fosdick, and W. R. Smith succeeds Mr. Charlton. E. B. Hall has been appointed a master mechanic, with office at Eagle Grove, Iowa, succeeding C. Coleman.

C. S. Millard, engineer maintenance of way of the Cleveland, Cincinnati, Chicago & St. Louis at Indianapolis, Ind., has been appointed engineer of track and roadway, with office at Cincinnati, Ohio. As has already been announced, W. B. McLoughlin, engineer maintenance of way at Mattoon, Ill., suceeds Mr. Millard. Joseph Mullen, engineer maintenance of way at Mt. Carmel, Ill., succeeds Mr. McLoughlin. A. S. More, engineer maintenance of way at Wabash, Ind., succeeds Mr. Mullen, and W. C. Kegler succeeds Mr. More. A. Maischaider, assistant engineer on the St. Louis division (of the Cleveland, Cincinnati, Chicago & St. Louis) has been transferred to the Chicago division, and Thomas Steiner, assistant engineer on the Cairo division, succeeds Mr. Maischaider.

Purchasing Officers.

A. B. Lacy has been appointed purchasing agent of the Virginian Railway, with office at Norfolk, Va.

F. H. Greene, general purchasing agent of the New York Central Lines, with office at New York, has had his authority extended over the Toledo & Ohio Central and the Zanesville & Western.

OBITUARY.

John C. Ilse, assistant general freight agent of the Chicago Great Western, at Chicago, died March 29, at the age of 60 years.

Ralph W. Hickox, formerly first vice-president of the Hocking Valley, died recently of apoplexy at Lyons, France, while on an automobile tour from Paris to Monte Carlo. Mr. Hickox was born in Cleveland, Ohio, and graduated from Harvard university in 1872.

Dudley Evans, president of the Wells, Fargo & Co. Express, died March 27 in New York. Mr. Evans was born in Morgantown, W. Va., January 27, 1838, and graduated from Washington college in 1859. He entered the service of the Wells, Fargo & Co. Express in 1886, becoming manager in 1892, and was later made vice-president, remaining in that position until his election as president in 1901.

Levi C. Weir, chairman of the board of managers and of the board of trustees of the Adams Express Co., died at his home in New York City on Monday last at the age of 68. Mr. Weir was president of the Adams Express Co. until May, 1909, when he resigned that office to take the chairmanship of the two governing boards. He was also a director of the United States Express Co. and of many railways and industrial and insurance corporations, including the Colorado & Southern, Des Moines & Fort Dodge, Iowa Central, Minneapolis & St. Louis and Norfolk & Western Railways.

George F. Gardner, general superintendent of the Gulf & Ship Island, with office at Gulfport, Miss., died at Gulfport on March 24. Mr. Gardner was born April 6, 1852, at Bremen, Ohio, and began railway work in April, 1865, as a telegraph operator on the Cincinnati, Wilmington & Zanesville, now the Cincinnati & Muskingum Valley, at Bremen. He was later operator and clerk at New Lexington, Ohio; train despatcher at Lancaster, Ohio, and trainmaster of the same road. In November, 1887, he was made superintendent of the Zanesville & Ohio River, now part of the Baltimore & Ohio, at Zanesville, Ohio, and in May, 1892, he was made general superintendent of the Cincinnati, Lebanon & Northern at Cincinnati, Ohio, where he remained for six months. He was then appointed master of transportation of the Pittsburgh, Akron & Western, now the Northern Ohio, and the next year he was appointed superintendent. For nine years from April, 1895, he was superintendent of the Middle and Clearfield & Mahoning divisions of the Buffalo, Rochester & Pittsburgh, which position he resigned to become general superintendent of the Gulf & Ship Island.

Railway Construction.

New Incorporations, Surveys, Etc.

ALEXANDRIA & WESTERN.—An officer writes that this company has located a line from Alexandria, La., west via Weil, Lamothe, Crane and Quadrate to Wilda; surveys made for 23 miles. Preliminary surveys have been extended further west, but the location beyond Wilda has not yet been made. Maximum grade 0.5 per cent. and maximum curvature 3 degs. There will be one steel bridge, a short plate girder span, over the state canal. I. W. Sylvester, chief engineer, Alexandria. (March 18, p. 749.)

ALGOMA CENTRAL & HUDSON BAY.—Bids are wanted by C. N. Coburn, chief engineer, Sault Ste. Marie, Ont., it is said, to build from Hawk Lake junction, Ont., to the Canadian Pacific. (Jan. 28, p. 209.)

ARBUCKLE & WESTERN.—Incorporated in Oklahoma, with $400,000 capital and headquarters at Ardmore, Okla. The plans call for a line from Ardmore northwest to Chickasha, 110 miles, with a branch from Milo, near Ardmore, northwest to Lawton, 65 miles. It is estimated that it will cost $16,000 a mile to build the line. The directors include: O. O. Ayers, J. R. Pennington and R. A. Hefner, Ardmore, and E. S. Ayers, Eddington, Kan.

CANADIAN NORTHERN.—Surveys have been made and bids will be asked for at once, it is said, to build from Hope, B. C., west to New Westminster, about 56 miles. Surveys are said to be made and bids will be asked for this spring to build from Edmonton, Alb., west to the Rocky mountains, about 200 miles. (March 4, p. 460.)

CENTRAL RAILROAD OF OREGON.—According to press reports plans are being made for an extension from Union, Ore., northwest through the Grande Ronde valley and over the Blue mountains to Walla Walla, Wash., about 80 miles. (June 18, p. 1328.)

CIENEGUITA & SONORA CENTRAL.—According to press reports from Hermosillo, Mex., this project is being financed by an American syndicate, headed by Charles Deering, of the International Harvester Co., Chicago. The plans call for a line through a mineral and coal section, and is to provide an outlet for the Cieneguita Copper Co. It is to connect with the Yaqui River branch of the Southern Pacific Railroad of Mexico at Tonichi. The line will be about 125 miles in length.

CLEVELAND, CINCINNATI, CHICAGO & ST. LOUIS.—An officer writes that a contract has been given to the Walsh Construction Co., Davenport, Iowa, to build the Evansville, Mt. Carmel & Northern, from Mt. Carmel, Ill., south to Evansville, Ind., about 43 miles. Maximum grades will be $^3/_{10}$ per cent. northbound and $^5/_{10}$ per cent. southbound with light curves. There will be a bridge over the Wabash river. The Cairo division will be double-tracked from El Dorado south to Ledford, 11 miles, also on a section from Chrisman north to Lyons, 23 miles. (March 11, p. 546.)

ERIE.—In five or six weeks the Erie expects that the Genesee River Railroad, building a low-grade line from Hunts, N. Y., south to Cuba, 33 miles, will be finished and perhaps put in operation about that time. The Erie & Jersey, a low-grade line between Guymard, N. Y., and Highland Mills, with the revision of that portion of the road between Highland Mills and Newburgh junction, is finished and is now in operation. Efforts are being made to complete the Bergen Hill, N. J., improvements so as to have the roadbed ready for the operation of trains in a short time. The Bergen Hill improvements include a four-track open cut, 70 ft. deep and 4,500 ft. long, through Bergen Hill, for passenger trains. The company has spent between $12,000,000 and $15,000,000 improving its freight service from the west, and for a better approach to the Jersey City terminal. (Dec. 3, p. 1107.)

EVANSVILLE, MT. CARMEL & NORTHERN.—See Cleveland, Cincinnati, Chicago & St. Louis.

GAINESVILLE, OKLAHOMA & WESTERN.—Incorporated in Texas, with $100,000 capital, to build from Gainesville, Tex., southwest through Cooke and Wise counties to a connection with

the Rock Island near Bridgeport; also to build from Gainesville, northeast to Red river, at or near Orlena, in all about 80 miles. The incorporators include: J. C. Whaley, G. C. N. Ball, H. W. Stark, T. M. King, O. F. Scott and J. T. Edwards, Gainesville.

GARDEN CITY, GULF & NORTHERN.—An officer writes that contracts have been let for building this line, the work to be started at the option of the railway company. The projected route is from Scott, Kan., south via Garden City, and Santa Fe to Liberal, 100 miles. Track laid on the first 40 miles from Scott, where connection is to be made with the Atchison, Topeka & Santa Fe and the Missouri Pacific south to Garden City. The work to be carried out is not difficult, being through a prairie section. There will be a bridge over the Arkansas river and another over the Cimarron river. The project has only been financed for the first 40 miles. The company was organized to build from Plains, Kan., on the Chicago, Rock Island & Pacific, north via Garden City and Scott to St. Francis, in Cheyenne county, about 225 miles. B. M. McCue, president, and William H. Cost, chief engineer, Garden City. (Nov. 5, p. 894.)

GRAND TRUNK PACIFIC.—A contract is said to be let to the J. D. McArthur Co., Winnipeg, Man., for a branch line from Regina, Sask., north to Portal.

GULF COAST & PROVIDENT CITY.—Plans are nearing completion, it is said, and work is to be started in April on the first section from Pierce, Tex., on the Galveston, Harrisburg & San Antonio, in Wharton county, west to Provident City, now known as Goldenrod, about 25 miles. As soon as that section is finished work will be started from Pierce to Houston. E. W. Townes, Houston, is attorney for the company. (Dec. 24, p. 1260.)

IRON MOUNTAIN, ST. GEORGE & GRAND CANYON.—Incorporated in Arizona to build from Thermo, Beaver county, Utah, on the San Pedro, Los Angeles & Salt Lake, south to Cedar City and Kanarraville, thence southwest via St. George to the Santa Fe, in the Hualapai valley, at or near Kingman, Ariz., about 240 miles, with a long branch below Kanarraville southeast through an oil and timber region to the grand canyon of the Colorado river. Shorter but important branches are also to be built from near Cedar City to the coal fields and iron mines in Iron county, Utah. The incorporators and directors include: J. R. Walker, C. Read, E. S. Kimball, E. Rykert and M. T. Burges, Salt Lake City.

JACKSONVILLE & ATLANTA SHORT LINE.—Organized to build from Jacksonville, Fla., northwest via Homerville, Ga., Ocilla, Fitzgerald and Perry to Fort Valley, about 225 miles. B. B. Gray, president, Pinebloom, Ga., and C. A. Holtzendorff, treasurer, Fitzgerald.

KANAWHA & MICHIGAN.—According to press reports the Lake Shore & Michigan Southern and the Chesapeake & Ohio, now in control of the Kanawha & Michigan, will make improvements on the road, including new tracks, some tunnel work and eliminating steep curves, at a total cost of $1,400,000.

KANSAS CITY, LAWRENCE & TOPEKA (ELECTRIC).—A contract is said to have been given to the Guilford Company, Kansas City, Mo., for building six miles of line from the present terminal at Shawnee, Kan., southwest to Zarah. (July 2, p. 35.)

MANUFACTURERS' RAILWAY (ST. LOUIS).—See an item under Railway Financial News in regard to this company.

MEXICAN PACIFIC.—According to press reports the building of this line is now assured. The state of Guerrero, Mex., has granted the company a subsidy for the section from Acapulca, Mex., to Zihuatanejo, about 110 miles. Surveys for the line have already been made and it is said that the construction work will be pushed. The promoters own a large tract of land in the coast section of the state of Guerrero, which it is proposed to colonize and develop. The line will parallel the Pacific coast for the entire distance. Joseph Castlelot, vice-president, Mexico City. (March 11, p. 547.)

MEXICAN ROADS.—A Consular report says that a concession has been given to William P. Wood to build a line from Santa Lucretia, at the junction of the Vera Cruz & Isthmus and the Tehuantepec National Railways, northeast to a point in Yucatan, where connection is to be made with the United Railways of Yucatan, 620 miles.

Alberta Lagorreta, of the state of Queretaro, Mex., recently obtained a concession from the federal government to build a 50-mile line between Mexico City and Queretaro City.

MINNEAPOLIS, ST. PAUL & SAULT STE. MARIE.—According to press reports, a decision of the courts permits this company to cross the Northern Pacific's tracks at grade for a period of two years, pending the erection of an overhead approach to the new station at Sixth avenue, west, in Duluth, Minn.

According to press reports, this company will build a line from Duluth, Minn., northwest to Thief River falls, 225 miles, and will also carry out a large amount of curve elimination work during 1910.

NATIONAL RAILWAYS OF MEXICO.—According to press reports a branch is to be built from La Capilla, Mex., on the main line of the Guadalajara division, south to Chapala, on the north shore of Lake Chapala, about 14 miles.

NEVADA-CALIFORNIA-OREGON.—An officer writes that contracts are to be let about April 10 to extend this road from Alturas, Cal., north to Lakeview, Ore., 50 miles. (March 18, p. 751.)

NEW YORK, NEW HAVEN & HARTFORD.—An officer writes that plans are under way for double-tracking the Berkshire division from Hawleyville, Conn., southeast to Bottsford, eight miles.

OMAHA, WESTERN & LINCOLN (ELECTRIC).—An officer writes that financial arrangements have not yet been completed for building this line, projected from Omaha, Neb., with a spur to South Omaha, west via Junction, Wahoo, Weston, David City, Osceola and Aurora to Hastings, 156 miles. A branch is also projected from Junction, which is 20 miles west of Omaha, south to Lincoln, 34 miles. The work will not be difficult. Maximum grades will be 1 per cent. and maximum curvature 4 degs. Preliminary survey has been made. The company owns about three miles of graded line, which was carried out by the old Omaha & Nebraska Central. There will be a bridge over the Platte river 2,000 ft. long. F. E. Schaff, president, Lincoln; W. H. Fuller, chief engineer, 233 University avenue, Hastings. (March 18, p. 751.)

OSAGE WESTERN.—An officer is quoted as saying that contracts are to be let in April for grading work on this road. It is expected to have the entire line from Vinita, Okla., west to Enid finished by August, 1910. E. J. Noonan, locating engineer, Muskogee. (Jan. 28, p. 209.)

PASCAGOULA NORTHERN.—Financial arrangements are said to have been made to build an extension of this road, now in operation for 45 miles in Jackson county, Miss., from Scranton, port of Pascagoula, north to a connection with the Mobile, Jackson & Kansas City. The projected extension will run northwest through Greene, Wayne, Jones, Smith, Scott, Leake, Attala, Montgomery, Webster, Calhoun, Lafayette, Tate and De Sota counties. (July 30, p. 215.)

PECOS-FORT STOCKTON.—According to press reports this company will build a line from Pecos, Tex., southeast to Fort Stockton, 51 miles. This new line will connect at Pecos with the Texas & Pacific, the Atchison, Topeka & Santa Fe and the Pecos Valley Southern, now building from Pecos south, and with the Kansas City, Mexico & Orient at Fort Stockton. W. G. Trotman, Minneapolis, Minn., may be addressed.

PRAIRIE FARM & SOUTHWESTERN.—Organized to build from Prairie Farm, Wis., southwest to Glenwood, or Emerald, about 20 miles. Surveys are now under way and financial arrangements partly completed. It is expected to begin construction work about the middle of April. G. E. Scott, president, Prairie Farm. (Feb. 4, p. 281.)

ST. LOUIS, BROWNSVILLE & MEXICO.—An officer writes that the company expects to begin work early in April on an extension of the Tres Palacios branch to Collegeport, in Matagorda county, Tex., 7.6 miles. The branch is already completed from the main line at Buckeye, southeast for nine miles. Sixty-five-pound rails will be laid on the extension. The grading contract will be let in a few days. The company will do the track laying with its own men.

ST. LOUIS EAST SIDE BELT TERMINAL.—Incorporated in Illi-

nois to build a belt line around East St. Louis, Ill. The proposed route is from a point near the Mississippi river, in St. Clair county, south of East St. Louis around the city to a point near Venice, in Madison county. The office of the company will be at East St. Louis. C. T. Smiley, O'Fallon; A. E. Meints, F. Kraft, W. H. Hause and J. L. Flannigan, East St. Louis, are said to be interested.

SALT LAKE-IDAHO.—Incorporated in Idaho by the Harriman interests, with a capital of $160,000, to build from Saline, Utah, on the Southern Pacific's Lucin cut-off north via Kelton through Raft River valley to Minidoka, Idaho, on the Oregon Short Line, 150 miles. W. H. Bancroft, J. M. Davis, D. E. Burley, P. L. Williams and F. H. Knickerbocker are interested.

SONORA RAILROAD.—See Southern Pacific of Mexico.

SOUTHERN PACIFIC.—According to press reports the Lucin cut-off across the Great Salt lake in Utah is to be double-tracked. As soon as the necessary material is received between 500 and 1,000 men are to be put to work.

SOUTHERN PACIFIC OF MEXICO.—This company has finished the main line down the Pacific coast of Mexico from Empalme, Mex., near Guayamas, southeast to Santiago river, 622 miles. The completed track has been accepted by the Mexican government, and subsidies, aggregating $6,275,000, have been paid on this section. Grading and track-laying is now in progress between Tepic and Orendain, which is on the National Railways of Mexico, 25 miles west of Guadalajara. Construction work through the Sierra Madres, north of Tepic, involves a number of problems, and it is understood that it will take about two years to complete the work. (Jan. 21, p. 164.)

The branch of the Sonora Railroad from Corral, Sonora, Mex., was opened on March 26 for general traffic north to Tonichi, 96 miles.

STATESVILLE AIR LINE.—Organized to build from Statesville, N. C., north to Mountairy, in Surry county, about 65 miles, thence to Radford, Va., 60 miles additional. It is said that financial arrangements are being made and that actual work will be begun this spring. The first section to be built will be from Statesville via Harmony and Yadkinville to Boonville, in Yadkin county, 42 miles. W. D. Turner, president; D. Mausley, treasurer and general manager. (Sept. 3, p. 427.)

STUTTGART & RICE BELT.—Organized in Arkansas, with $78,000 capital, to build from Mesa, Prairie county, Ark., south to Stuttgart, thence to Coopers, Arkansas county, 40 miles. The directors include: J. R. Porter, W. M. Price, R. H. Toll, E. Pettit and P. Reinsch.

TERRELL-DALLAS INTERURBAN.—Organized in Texas to build from Dallas, Texas, east to Terrell, about 30 miles. Surveys made and right-of-way secured for 23 miles. C. L. Wakefield, E. W. Morton, Jr., E. Gray and T. Layden, Dallas, are interested. William Cook, chief engineer. (See Dallas Interurban, Sept. 10, p. 477.)

TUCUMCARI, PORTALES & GULF.—Bids have been received, it is said, and work will be started early in April from Pyote, Tex., north to Duval, 25 miles. The plans call for a line from Tucumcari, N. Mex., southeast to Pyote, thence to Del Rio. M. J. Healy, president and general manager, Pyote. (March 11, p. 548.)

UNION PACIFIC.—According to press reports a branch from Wamsutter, Wyo., to a point near Craig, Colo., will be built during the coming summer. Kilpatrick Brothers, Beatrice, Neb., is said to have the general contract, and it is understood that a sub-contract is let to Reinhardt Brothers.

WEST PENN RAILWAY CO.—See West Penn Traction.

WEST PENN TRACTION.—According to press reports from Greensburg, Pa., this is to be the new name of the West Penn Railways Co., which will be reorganized. It is planned to carry out the improvements under consideration for about six months, including the construction of a trunk line connecting West Newton, Pa., with McKeesport. Surveys have been completed for a line from Greensburg east to Latrobe, and it is understood that the line will eventually be extended further east to Ligonier. As soon as consent is obtained from the Greensburg council, and the right-of-way secured through streets in that place, work on the Latrobe-Crabtree branch will be started.

Railway Financial News.

ATCHISON, TOPEKA & SANTA FE.—The directors have voted to issue new convertible 4 per cent. bonds to the extent of 14 per cent. of holdings to holders of common and preferred stock of record April 19 at 102½. For this purpose $43,686,000 new 50-year bonds have been authorized. The bonds are the balance of $98,000,000 authorized three years ago, of which $26,056,000 were issued as 5s in 1907 and $28,258,000 more as 4s, last July. As of a recent date, Atchison had outstanding $41,259,500 convertible bonds, about $20,000,000 of which are the so-called old fours, sold in 1905 and 1906. With the above new lot the company will have issued a total of $146,727,000 convertibles, all exchangeable at par. With $41,259,500 convertibles yet outstanding and $163,725,000 common stock out, the new bonds will bring the total amount of common eventually to be issued up to $248,670,000. The new bonds will not be offered to convertible bondholders unless they change their bonds into common stock before April 19.

Walker D. Hines, acting chairman of the Atchison executive committee, made the following statement:

"The issue, just authorized, of $43,686,000 of 50-year 4 per cent. convertible bonds, is to aid in providing the necessary capital expenditures, aggregating over $46,000,000, designed to enlarge the capacity of the lines now in operation. The territory served by the Atchison system is developing with extraordinary rapidity, and the largely increased business already in sight urgently requires these improvements, and insures a very large increase in the earnings of the system.

"It may be stated in addition to the foregoing that the company is expending over $18,000,000 for new equipment and is constructing nearly 600 miles of additional railway in the state of Texas to serve a very extensive territory which is now almost entirely without railway facilities.

"Important portions of this additional mileage are expected to be in operation within a year, and it is believed will still further increase to a large extent the earnings of the system."

The new bonds have been underwritten.

BANGOR & AROOSTOOK.—Brown Brothers & Co., New York, are offering the unsold portion of the total authorized issue of $1,650,000 Wabash extension first mortgage 5 per cent. bonds of August 1, 1909-1939, at par. These bonds are secured by a first mortgage at the rate of $30,000 a mile on a cut-off connecting two of the principal lines of the company in northern Maine.

BIRMINGHAM TERMINAL.—Walter L. Ross & Co., Philadelphia, are offering $1,500,000 first mortgage 4 per cent. bonds of 1907-1957 of the Alabama Terminal Co. at 92, yielding about 4.40 per cent. on the investment. These bonds are guaranteed jointly by the Southern Railway, the Illinois Central, the Seaboard Air Line, the Central of Georgia, the St. Louis & San Francisco and the Alabama Great Southern.

BUFFALO & SUSQUEHANNA.—Among the securities owned by Fisk & Robinson, bankers, whose affairs were recently placed in the hands of a receiver, are $968,450 Buffalo & Susquehanna bonds, $411,100 preferred stock and $24,310 common stock.

CHATTANOOGA SOUTHERN.—Newman Erb and associates have bought a majority of the $2,250,000 common and $750,000 preferred stock. The property has been in the hands of a receiver since April 1, 1907. The road runs from Chattanooga, Tenn., to Gadsden, Ala., 92 miles.

CHESAPEAKE & OHIO.—In the call for a stockholders' meeting for April 28 to authorize the issue of $31,390,000 4½ per cent. convertible bonds of February 1, 1910-1930, the official circular says that the bond sale is made to provide funds among other things for the acquisition of the majority of the common stock of the Hocking Valley and of substantial interests in the stock of the Kanawha & Michigan, and for the acquisition from interests in control of pending foreclosure proceedings, who have agreed to acquire the same

at foreclosure sale, of the property of the Chicago, Cincinnati & Louisville, or of the securities representative thereof; for additions and betterments to the property and for the purchase of additional motive power and equipment. The sale of bonds has been underwritten, and they are offered to stockholders at 93½ to the extent of 50 per cent. of their respective holding of common stock.

Chicago, Cincinnati & Louisville.—See Chesapeake & Ohio.

Colorado Southern, New Orleans & Pacific.—This company, which operates the line of the St. Louis & San Francisco system running from Houston, Tex., to Baton Rouge, La., has changed its name to the New Orleans, Texas & Mexico, and the line of the St. Louis & San Francisco running from Houston, Tex., to Brownsville, will also hereafter be part of the New Orleans, Texas & Mexico.

Denver & Rio Grande.—The New York Stock Exchange has listed $4,000,000 additional preferred stock and $3,006,000 additional first and refunding mortgage 5 per cent. bonds, with authority to add $427,000 additional bonds on notice of sale. The preferred stock has been sold at par for cash, and of the proceeds $3,160,000 has been used to reimburse the treasury for recent betterments and for equipment acquired, and the balance, $840,000, is on deposit to be used for like purposes. Of the $3,433,000 bonds issued, $433,000 are for corporate purposes, $1,435,000 were issued to acquire second mortgage 5 per cent. bonds of the Western Pacific (the entire $25,000,000 second mortgage bonds have now been acquired), and $1,565,000 for additions and betterments.

Georgia, Southern & Florida.—This company has filed an equipment mortgage securing an issue of $500,000 4½ per cent. bonds, due in instalments of $50,000 yearly.

Kanawha & Michigan.—All of the majority directors except N. Monsarrat have resigned, and Edwin Hawley, Frank Trumbull, W. C. Brown, C. E. Schaff and A. H. Gillard have been elected directors in their place. The minority directors, W. H. Goadby, O. F. Roberts and George D. Mackay, were re-elected.

The new stockholders' committee, consisting of J. S. Stanton, D. H. Gould and Samuel Untemeyer, have issued a circular opposing the acceptance of the offer of $72 per share for the minority stock made by the Chesapeake & Ohio and the Lake Shore & Michigan Southern. The circular says:

"We understand that the promises made by the past management to pay dividends during the present year equal to 40 per cent. of the net earnings and to pay a stock dividend amounting to about 11 per cent. in order to recoup the stockholders for the loss of past dividends are repudiated by the purchasing company. It was upon these promises and not on the recommendation of the Mackay committee that the minority stock was allowed to be retained."

Lake Erie & Western.—This company, slightly more than half of whose common and preferred stock is owned by the Lake Shore & Michigan Southern, had total operating revenues in the year ended December 31, 1909, amounting to $5,043,990. This compares with $4,361,158 in 1908. The miles operated in 1909 were the same as in 1908, namely, 886 miles, the main line running from Peoria, Ill., to Sandusky, Ohio, with branches to Minneapolis, Fort Wayne, etc. The total operating expenses last year were $3,860,443, comparing with $3,660,393 in the year before. This left an operating income of $966,123 in 1909 and $487,114 in 1908. The company paid no dividends in either 1908 or 1909. There was charged for additions and betterments $56,965 in 1909 and nothing in 1908. After the payment of fixed charges and other deductions from income the company had a surplus in 1909 of $91,105 as against a deficit in 1908 of $240,440. Freight revenue last year was $3,972,410, an increase of $624,829, mostly during the last half year and due to the general restoration of business activity and to improved train schedule. President Brown says that general conditions were never more favorable. Under operating expenses $769,087 were spent for maintenance of way in 1909 and $778,337 in 1908. Maintenance of equipment cost $981,127 last year and $797,790 the year before. Transportation expenses cost $1,843,506 last year and $1,818,657 the year before.

The total tonnage of all products carried amounted to 4,487,722 tons in 1909 and to 3,696,681 tons in 1908. The total freight-car miles run in 1909 amounted to 45,772,565 and to 40,241,050 miles in 1908. The loaded car mileage last year totaled 32,324,705, comparing with loaded car mileage of 26,718,260 in 1908, and empty car mileage totaled 11,802,907 in 1909, comparing with 12,002,811 in 1908. Nearly all classes of commodities furnished a greater tonnage in 1909 than in 1908. The most noticeable increases in tonnage furnished are in the cases of machinery and other castings, the tonnage of which amounted to 285,127 tons in 1909 and to 171,363 tons in 1908, and flour, the tonnage of which amounted to 1,024,621 tons in 1909 and 72,524 tons in 1908. The tonnage of bituminous coal also increased considerably. The noticeable exceptions to increases in tonnage of commodities is in the case of live stock, which furnished 84,524 tons in 1909 and 98,330 tons in 1908, and anthracite coal, which furnished 96,713 tons in 1909 and 106,001 tons in 1908. The average haul of revenue freight was 129 miles in 1909 and 127 miles in 1908, and the average revenue per ton per mile was 6.86 mills in 1909 and 7.15 mills in 1908. The average revenue train load was 328 tons in 1909 and 295 tons in 1908.

The balance sheet, as of December 31, 1909, shows total current assets of $1,333,998, of which $622,149 is cash and $373,446 materials and supplies. Current liabilities amounted to $2,478,563, of which $1,180,016 was loans and bills payable.

Manufacturers' Railway (St. Louis).—Stockholders have authorized an increase in the stock from $250,000 to $5,000,000, and have authorized a bond issue of $5,000,000, the proceeds of which are to be used to build east and west terminals for St. Louis. The company was incorporated in 1887 and owns and operates about 21 miles of track at St. Louis, Mo. It has been controlled by Adolphus Busch and associates. President Moore says:

"The Manufacturers' Railway, when completed, will afford trans-Mississippi river service by way of barge lines or car floats. It will also be in a position to connect with the free bridge, both on the Illinois and Missouri sides of the river. In addition it is the purpose of the company to construct a line through the southwestern section of the city of St. Louis to furnish an independent entrance for any road now constructed or to be constructed. Considerable work has been done to make possible a line between Fort Smith and St. Louis, which will be from 100 to 125 miles shorter than any other of the existing lines. The Manufacturers' Railway is only interested in such matters so far as to secure tenants."

New Orleans, Texas & Mexico.—See Colorado Southern, New Orleans & Pacific.

New York Central & Hudson River.—Stockholders are to vote April 20 on modifying the lease of the Dunkirk, Allegheny Valley & Pittsburgh so as to provide that in addition to the annual dividend payment of 1½ per cent. on the $1,300.000 stock there shall be paid as rental interest on such bonds as may be issued to refund bonds now outstanding and such bonds as may be issued for extensions and improvements.

St. Louis & San Francisco.—See Colorado Southern, New Orleans & Pacific.

St. Louis, Iron Mountain & Southern.—The New York Stock Exchange has listed $1,785,000 additional River & Gulf division 4 per cent. bonds of 1903-1933. Of these bonds $1,026,966 were issued to pay for second-track and terminals at St. Louis, Thebes and East St. Louis, and $758,208 were issued to build 1.43 miles of road between Batesville, Ark., and Newark, and for improvements.

Wabash.—The company has sold $5,000,000 new 5 per cent. notes of May 1, 1910-1913, to Blair & Co. and Kuhn, Loeb & Co., both of New York. The company is to pay off $6,000,000 4½ per cent. notes, maturing May 1. The new notes are secured by the collateral securing the old issue of notes, and in addition by the deposit of a block of Wabash 4 per cent. bonds.

Western Pacific.—See Denver & Rio Grande.

Supply Trade Section.

T. P. O'Brian has entered the sales department of the O. M. Edwards Company, Syracuse, N. Y. Mr. O'Brian's headquarters will be at 3099 Broadway, New York.

R. P. C. Sanderson has resigned as superintendent of motive power of the Virginian Railway to become general superintendent of the new works of the Baldwin Locomotive Works at Eddystone, Pa.

G. H. Groce, assistant general manager of the Illinois Central and the Indianapolis Southern, with office at Chicago, has resigned to enter the employ of the General Railway Signal Co., Rochester, N. Y.

William C. Kuntz, sales agent of the Pennsylvania Steel Co., Steelton, Pa., will on May 1 sever his connection with that company, and is to take a position with the Goldschmidt Thermit Co., New York.

The Mt. Vernon Bridge Co., Mt. Vernon, Ohio, will soon begin the building of a new plant to replace the one destroyed by fire. The main building will be 500 ft. x 135 ft. and the template shop 40 ft. x 128 ft.

The Safety Car Heating and Lighting Co., New York, will on May 1 move its Chicago office from the Monadnock building to the 19th floor of the new People's Gas building, Michigan avenue and Adams street.

F. X. Cleary has been appointed advertising manager of the Western Electric Co., New York. Mr. Cleary has been with the Western Electric Co. for about 20 years, during which time he has held important positions in the sales department.

H. Sanborn Smith has resigned, effective April 1, as general sales agent of the Lackawanna Steel Co., New York, intending to devote all of his time to personal interests. Charles R. Robinson has been appointed general sales agent to succeed Mr. Smith.

The Isthmian Canal Commission will receive bids until April 19 for piles, staybolt iron, brass screws, sulphate of copper, yellow ocher, chrome green and chrome yellow (Circular No. 569); and until April 25 for lumber, steel, iron and manila rope (Circular No. 570).

A. J. Davidson, who resigned from the presidency of the St. Louis & San Francisco in November, 1909, has accepted the office of vice-president of the American Creosoting Co., Chicago. He will have charge of the development of the company's business in the southwest.

The O. M. Edwards Co., Syracuse, N. Y., is adding to its present business the manufacture of gates, globes, angles, hoes, checks and radiator valves. These articles will be made in brass, but it is the intention later to go extensively into the manufacture of iron and steel valves.

The Northwestern Metal Manufacturing Co., 1328 North Second street, Minneapolis, Minn., want representatives to handle their line of metallic packing and railway specialties in Chicago, St. Louis, New Orleans, New York, Pittsburg, Cincinnati, Seattle, Texas and the Pacific coast.

The Anderson Forge & Machine Co., Detroit, Mich., is beginning work on a new plant at Jefferson and Kercheval avenues, which it is estimated will cost $750,000. There will be eight concrete buildings and a brick office building. The company makes drop forgings for all purposes, crankshafts, special forgings, cold chisels and special tools.

Burton W. Mudge & Co., Chicago, announce that, effective February 1, 1910, they assumed the exclusive right to handle the Garland ventilator for both passenger and freight equipment, and the Garland heating and refrigerating appliances for freight cars. The company will be glad to furnish any information on the ventilating and refrigerating of all kinds of equipment.

The Burton Tracklaying Machine Co. has been incorporated in Utah with a capital of $300,000 to manufacture a tracklaying machine patented by Charles W. Burton. The company will have offices in Salt Lake City, Utah. The officers are: Charles W. Burton, president; H. Borman, vice-president and treasurer, and S. H. Lynch, secretary. It is the intention to build a machine at once for demonstration.

Walter M. McFarland, who has been associated with the Westinghouse Electric & Mfg. Company, Pittsburgh, Pa., since January 1, 1899, has resigned to accept an official position with the Babcock & Wilcox Company, New York. Mr. McFarland has occupied the office of acting vice-president of the Westinghouse company for a period extending over 10 years. In this capacity he has had official supervision of the large contracts of the company, as well as being the advisory head in all the co-operative movements of the company with the associated Westinghouse companies involving literature, advertising and exhibition work.

W. M. McFarland.

As a frequent representative of the Westinghouse companies at important meetings of engineering societies and at conventions, he is well known, and he has long been considered by his company as its official host. In the latter capacity he has come into contact with many distinguished engineers and other guests from all parts of the world. His broad experience in the activities of the company and in engineering matters in general, attained through his previous work in the United States Navy, and his personal acquaintance with men of public affairs, particularly fitted him for duties of this character.

Mr. McFarland was born in Washington, D. C., in 1859. He obtained his education in the public schools of Washington, the preparatory department of Columbia University and the United States Naval Academy. He entered the latter institution as a cadet engineer in 1875, and in 1879 was graduated second in his class. In 1881 he was commissioned as assistant engineer; in 1891 as past assistant engineer, and in 1898 as chief engineer. For more than 20 years he was the youngest officer to have reached the latter grade. When the Personnel Board was assembled by the Secretary of the Navy in 1897, Mr. McFarland acted as the sole sponsor for the younger men of his corps. He was one of the most active and effective supporters of the amalgamation scheme, the recommendation of which was the main result of the deliberation of the board. In 1899 he was commissioned lieutenant and in the same year resigned to enter the employ of the Westinghouse Electric & Manufacturing Company. In 1882 he was detailed for service in the Bureau of Steam Engineering. From 1883 to 1885 he was detailed from the navy as assistant professor of Mechanical Engineering at Cornell University, and during the years 1885 and 1886 he was occupied with the inspection of machinery then building, and with work on preliminary design for proposed vessels. From 1889 to 1894 he was again attached to the Bureau of Steam Engineering. Mr. McFarland was vice-president of the American Society of Mechanical Engineers in the year 1907, and at the present time is vice-president of the Society of Naval Architects and Marine Engineers. He is also a member of the Engineers Club of New York, Duquesne Club of Pittsburgh, the Army and Navy Club of Washington, and the Army and Navy Club of New York.

TRADE PUBLICATIONS.

Great Northern.—"Washington, Idaho, British Columbia & Oregon" is the title of a Great Northern bulletin just issued.

Thirty-eight pages are filled with information and photographs of interest to home-seekers.

Joseph T. Ryerson & Son.—Two additions have recently been made to the Ryerson technical library, No. 10 on tool steel and No. 13 on "Glyco." The books are of the standard size of that company's publications, 4½ in. by 7½ in. No. 10 contains 64 pages and No. 13, 80 pages. Both are full of useful information and tables for users of tool steel and babbitt metal.

RAILWAY STRUCTURES.

Calgary, Alta.—N. E. Brooks, division engineer, Canadian Pacific at Calgary, is receiving bids for several concrete subways, arch culverts and concrete abutments for steel spans.

The Canadian Pacific is having plans made for the construction of a high level bridge near Calgary, and to make important improvements to its station at Brandon, Man.

Chicago, Ill.—See an item under General News regarding the Chicago Terminal Transfer.

Cleveland, Ohio.—According to press reports an agreement has been reached between the Pennsylvania Railroad and the city of Cleveland, whereby the railway company secures the right to make certain fills to the north of Whisky island in the Cuyahoga river, which will enable the company to make about 100 acres of new land and add extensively to its present dock facilities. With the Whisky island improvements and the new union station that is assured, the railways entering Cleveland will spend upward of $30,000,000 in Cleveland within the next two or three years.

Denison, Tex.—The Missouri, Kansas & Texas has let a contract to James Stewart & Co., St. Louis, Mo., for building its new car shops to replace those burned last June. Five buildings of fireproof construction are included in the plans and the total cost is estimated at $100,000.

Lansing, Mich.—An officer of the Lake Shore & Michigan Southern writes regarding the reports that extensive improvements are to be made at Lansing that this is not true, as no extensive improvements are contemplated.

Logansport, Ind.—The Ft. Wayne & Wabash Valley Traction Co. expects to build an interurban station for freight and passenger service, estimated to cost $40,000. A site has not yet been selected.

Mariscal, Mex.—A concession has been granted by the Guatemalan government to David E. Thompson, president of the Pan-American Railroad, to build the international bridge to be used for railway and highway traffic over the Suchiate river between Mexico and Guatemala. The Mexican government has already granted permission to build the bridge, which will be used primarily for an entrance of the Pan-American into Guatemala. (Jan. 7, p. 71.)

Minnedosa, Man.—An officer of the Canadian Pacific writes that the new station to be built in Minnedosa will be of brick, with shingle roof, and is to cost $10,000. Contracts were let March 28, and work is to be started about April 10. (March 18, p. 754.)

New York.—Bridge Commissioner Martin has submitted to the Board of Estimate and Apportionment estimates for strengthening the Williamsburg bridge over the East river connecting the boroughs of Manhattan and Brooklyn, for the purpose of running heavier cars over it. The commissioner is quoted as saying that the bridge should be reinforced by two supporting towers under each land span, and supporting towers under each end of the central span.

Vancouver, Wash.—The Northern Pacific has given contracts to the Hurley-Mason Co. for 27 new bridges between Vancouver and Tenino. The total cost of the work will be about $500,000.

Wheeling, W. Va.—An officer of the Baltimore & Ohio writes regarding the new freight station to be built at Wheeling, to cost about $300,000, that the new terminal is included in the plans of President Willard for increasing the Baltimore & Ohio's facilities in West Virginia. It has not yet been definitely decided just what kind of building will be put up, and the plans have not been made. (March 25, p. 853.)

Late News.

The items in this column were received after the classified departments were closed.

The Erie Railroad is asking local contractors for bids to reconstruct its station in Buffalo, N. Y., which was damaged by fire. It is expected that the improvements will cost between $25,000 and $30,000.

The New York, New Haven & Hartford has filed with the Interstate Commerce Commission new tariffs governing passenger rates, which make a horizontal increase of 5 cents per ticket on all tickets sold by the company of $1.70 and over. In some instances the increase applies on tickets costing less than $1.50. The new tariffs become effective May 1.

A free bridge to cost $500,000 is to be built over the Arkansas river between Fort Smith, Ark., and Van Buren. The Fort Smith Light & Traction Co., which operates electric lines in Fort Smith, has extended its line to the proposed approach of the bridge, and is asking permission to operate over the structure. Plans are also under consideration for an extension of the line. The Fort Smith-Van Buren & Western Arkansas Electric is also seeking permission to cross the bridge.

The new officers of the Baltimore & Ohio, Chicago Terminal Railroad, are as follows: Daniel Willard, president; Frederick C. Batchelder, first vice-president; H. L. Bond, Jr., second vice-president; J. P. Leary, controller; F. B. Worthington, auditor; J. V. McNeal, treasurer, and C. W. Woolford, secretary. F. E. Blaser, superintendent of the Cumberland division of the Baltimore & Ohio, has been appointed general superintendent of the main line system of the B. & O., succeeding Mr. Batchelder.

The action of the Pennsylvania in making a general increase in the pay of employees, noted in another column, was followed on Wednesday by a similar notice from the Philadelphia & Reading. The Reading order is limited to employees receiving less than $300 a month, but it does not include certain classes whose wages have been revised within the last 90 days. Including those who have recently had an increase and those affected by the present order, there are about 37,000 persons. The Norfolk & Western had advanced the pay of telegraphers 5 per cent.

Professor George Leonard Vose, professor of civil engineering at Bowdoin college from 1872 to 1882 and at Massachusetts Institute of Technology for the following four years, died March 30 at Brunswick, Me. Professor Vose was a well known writer on civil engineering subjects and had been a valued contributor to the *Railroad Gazette*. He began his professional career in the office of Samuel Nott in Boston in 1848. He studied at Lawrence Scientific school, Cambridge, and following that was in the railway service for a number of years. He was one of the editors of the *American Railway Times*, published in Boston from 1860 to 1864.

It is understood that arrangements have been made between the Moore-Reid interests and the Morgan interests in Lehigh Valley, under which a plan of financing will be brought out on the following lines:

1. To repay a part of the improvement to the Lehigh Valley property made of late years from earnings, it is proposed to declare a 50 per cent. cash dividend, or $25 per share, upon the $40,000,000 Lehigh Valley shares which have a par value of $50.

2. It is proposed to give stockholders the opportunity to take another share of stock at its par value of $50, which will furnish the money for the cash dividend and for still further improvements and the redemption of $6,000,000 second mortgage 7 per cent. bonds maturing September 1 next.

3. It is proposed that President Thomas become chairman of the board and that Mr. Miller, of the Chicago & Eastern Illinois, succeed Mr. Thomas as president of the Lehigh Valley.

4. It is proposed that the stock be listed in New York as soon as practicable.

Equipment and Supplies.

LOCOMOTIVE BUILDING.

The St. Louis & San Francisco has ordered five Mallet locomotives from the American Locomotive Co.

The Winston-Deere Co. has ordered five switching locomotives from the Baldwin Locomotive Works.

The Browndell Improvement Co. has ordered one 17-in. x 24-in. tank locomotive from the American Locomotive Co.

The Missouri, Oklahoma & Gulf has ordered four consolidation locomotives from the Baldwin Locomotive Co. for September delivery.

The Pennsylvania Railroad will build 105 locomotives at its Juniata shops, including the following classes: H 8 b, K 2, E 3 d, E 5, B 6 and B 8.

The Carter Construction Co., Chicago, has ordered four switching locomotives from the Baldwin Locomotive Works, and one tank locomotive from the American Locomotive Co.

The Mineral Range Railroad has ordered six 23-in. x 30-in. consolidation freight locomotives and two 19-in. x 26-in. six-wheel switching locomotives from the American Locomotive Co.

The New Orleans, Texas & Mexico has ordered 12 consolidation locomotives from the American Locomotive Company and 13 consolidation, five Pacific and five switchers from the Baldwin Locomotive Works.

The Colorado & Southern has ordered seven switching locomotives from the Baldwin Locomotive Works. Orders for the remaining locomotives, inquiries for which were reported in the *Railway Age Gazette* of March 11, will not be placed at this time.

The Denver, Northwestern & Pacific, as reported in the *Railway Age Gazette* of February 11, has ordered 12 consolidation, seven Mallet and one 10-wheel passenger locomotive from the American Locomotive Co. Delivery is specified for June and September, 1910.

General Dimensions.

	Consolidation.	Mallet.	10-wheel.
Weight on drivers.....	195,000 lbs.	327,000 lbs.	149,000 lbs.
Total weight	219,000 "	327,000 "	200,000 "
Diameter of cylinders.	22 in.	21 & 33½ in.	20½ in.
Stroke of pistons	28 in.	32 in.	28 in.
Diameter of drivers ...	55 in.	55 in.	63 in.
Type of boiler.....	Ext. wgn top.	Straight top.	Ext. wgn top.
Working steam press..	210 lbs.	225 lbs.	200 lbs.
Heating surface, tubes.	3,325 sq. ft.	5.035 sq. ft.	3,054 sq. ft.
" " firebx	213 "	236 "	199 "
" " total.	3,538 "	5,271 "	3,253 "
Tubes, number	426	409	400
" outside diameter	2 in.	2¼ in.	2 in.
" length	15 ft.	21 ft.	14 ft. 8 in.
Firebox, length	108 in.	108 in.	108 in.
" width	72¼ "	96¼ "	70¼ "
Grate area	54.2 sq. ft.	72.2 sq. ft.	52.6 sq. ft.
Water capacity	8,000 gals.	9,000 gals.	7,000 gals.
Coal capacity	12 tons.	12 tons.	10 tons.

The following special equipment will be used on all the locomotives:

Special Equipment.

Axles	Otis Steel
Bell ringer	Trojan
Boiler lagging	Sectional magnesia
Brakes	Westinghouse
Brake-beams	"Creco"
Brick arch	Am. Locomotive Equipment Co.
Couplers	Sharon
Fire doors	Franklin
Headlight	Pyle-National
Injector	Nathan Mfg. Co.
Journal bearings	More Jones Co.
Piston and valve rod packing	Paxton-Mitchell
Safety valve	Ashton
Sanding devices	Leach
Sight-feed lubricators	Nathan Mfg. Co.
Springs	Railway Steel-Spring Co.
Steam gages	Ashton
Steam heat equipment	Safety Car Heating & Ltg. Co.
Tires	Latrobe
Tubes	Worth Bros.
Valve gear	Walschaert

The Missouri, Kansas & Texas, reported in an unconfirmed item in the *Railway Age Gazette* of March 11, to have ordered locomotive equipment, has ordered five ten-wheel passenger, 10 Pacific passenger, 20 consolidation freight, 20 Mogul freight and 10 switching locomotives from the American Locomotive Co.

CAR BUILDING.

The Northwestern Elevated, Chicago, is taking prices on 20 cars.

The Elgin, Joliet & Eastern is in the market for 500 steel hopper cars.

The St. Joseph & Grand Island has ordered two 70-ft. McKeen motor cars from the McKeen Motor Car Co.

The Coal & Coke Railway is said to be considering the purchase of 500 coal cars. This item is not confirmed.

The Chicago, Rock Island & Pacific has ordered two 70-ft. McKeen motor cars from the McKeen Motor Car Co.

The Atchison, Topeka & Santa Fe has ordered three 70-ft. McKeen motor cars from the McKeen Motor Car Co.

The Los Angeles Railway, Los Angeles, Cal., is reported in the market for 90 electric cars. This item is not confirmed.

The American Smelting & Refining Co. is reported as being in the market for 100 steel ore cars. This item is not confirmed.

The New Orleans & Northeastern has recently had 10 thirty-ton box cars built at the Hattiesburg, Miss., shops of the Mississippi Central.

The Vandalia has ordered 800 fifty-ton steel hopper cars from the Cambria Steel Co. and 50 steel underframe stock cars from the Standard Steel Car Co.

The Portland Ry., Light & Power Co., Portland, Ore., is reported to have ordered 40 passenger cars from the American Car Co., the trucks to be furnished by the J. G. Brill Co.

The Chicago, Burlington & Quincy, reported in the *Railway Age Gazette* of March 4 as asking prices on 1,000 fifty-ton gondola cars, has ordered this equipment from the Pressed Steel Car Co.

The Pennsylvania is said to be in the market for 100 coaches, 10 combination, 50 suburban, 10 suburban-combination and five express horse cars for the Lines West, and 65 cars of different types for the Lines East. This item is not confirmed.

The Chicago, Rock Island & Pacific has ordered 25 caboose cars from the Mt. Vernon Car Mfg. Co. The inquiry for 250 refrigerator cars reported some time ago is still pending and in addition a new inquiry has been issued for 800 forty-ft., 40-ton box cars of the same type as those recently ordered from the Western Steel Car & Foundry Co., 500 thirty-six-ft., 40-ton stock cars, 200 fifty-ton ballast cars, 250 forty-ft. automobile cars and 250 fifty-ft. furniture cars. All of the cars in the recent inquiry will have steel underframes.

The Missouri, Kansas & Texas, reported in the *Railway Age Gazette* of February 4 as being in the market for freight and passenger equipment, has ordered the following cars: From the American Car & Foundry Co., 1,000 thirty-ton box, 200 thirty-ton automobile, 325 fifty-ton steel underframe gondola, 100 fifty-ton steel underframe flat cars and 15 coaches, 15 chair cars, 6 combination mail and coaches and 10 baggage cars; from the Mt. Vernon Car Manufacturing Co., 300 thirty-ton furniture, 175 forty-ton side dump coal and 50 standard caboose cars, and 5 postal cars from the Barney & Smith Car Co.

MACHINERY AND TOOLS.

The Baltimore & Ohio is in the market for machinery and tools for its shops at Huntington, W. Va. The order will be placed by Westinghouse, Church, Kerr & Co., New York.

The Baltimore & Ohio Southwestern has received bids on machinery for its Washington, Ind., shops, which will cost about $61,000.

IRON AND STEEL.

The Delaware, Lackawanna & Western is in the market for 500,000 tie plates.

The Cincinnati, Hamilton & Dayton is in the market for 1,600 tons of bridge steel.

The Boston Elevated has ordered 1,500 tons of rails from the Pennsylvania Steel Co.

The Great Northern has ordered 2,000 tons of structural steel from the Wisconsin Bridge & Iron Co.

The Omaha & Council Bluffs Railway has ordered 1,700 tons of structural steel from the Wisconsin Bridge & Iron Co.

The New York, New Haven & Hartford is to receive bids April 12 on steel for a bridge at Middletown, Conn. The requirements call for 1,200 to 1,500 tons. The company has ordered 9,000 tons of O. H. rails from the Maryland Steel Co. and 4,500 tons from the Bethlehem Steel Co.

General Conditions in Steel.—Present indications are thought to indicate a good showing in new steel orders during April. It is estimated that present inquiries amount to about 300,000 tons of structural steel, rails and shapes, a large proportion of which will very probably become orders before May 1. The earnings of the United States Steel Corporation for the first quarter of this year are expected to run in the neighborhood of $41,500,000. March earnings were heavy, to which is due the expected good showing for the quarter.

SIGNALING.

The General Railway Signal Co. will install nine type 2-A top post, automatic block signals between M. P. 27 and M. P. 51 on the Duluth & Iron Range, double-track. These signals will give three indications in the upper right hand quadrant and will be operated by portable storage battery, housed in concrete wells.

The Federal Signal Co. has been awarded the contract to build an interlocking plant for the Waterloo, Cedar Falls & Northern, an electric railway at Waterloo, Ia., at the crossing of the Rock Island. There will be a mechanical machine controlling upper quadrant power operated signals on the Rock Island and mechanical dwarf signals and derails on the Waterloo, Cedar Falls & Northern. The apparatus will be so arranged that the route will be normally lined up for Rock Island trains, and it will be operated by the crews of the electric cars.

Corrugated Steel for Cans and Pails.

The Steel Basket Co., Cedar Rapids, Iowa, makes a full line of cans, pails and baskets from the best grade of galvanized sheet steel designed to outlast bamboo, rattan, ash or oak several times. One of the company's specialties is a safety oily waste can, which is fully endorsed by underwriters. It has self-closing covers which open from both sides, four legs and a center support, a double bottom with all seams riveted and soldered. All these products are made to nest for shipment, thereby securing the third class freight rate.

Lacroix Battery Chute.

F. Lacroix, engineer of the Electrical Automatic Railroad Safety Signal Co., 25 Broad street, New York, has put in use, in connection with his experimental installation of cab signals on the Erie Railroad, near Newark, N. J., some battery chutes embodying two decided improvements over the ordinary style. These chutes are made of cast iron, and their general shape is shown in Fig. 1. The elevator supporting the jars is suspended by chains, running over pulleys, as shown, and is counterweighted so that when pulled up the jars can be stopped in any position; as, for example, that shown in Fig. 2, where the upper of the two jars stands in a position convenient for examination or cleaning. By further turns of the crank the lower jar may be brought into the position shown. The second improvement is the lock by which the cover is fastened. These locks are simple gravity catches, and their appearance is shown in Fig. 2, where the cover, bottom side out, stands on the ground outside of the chute. This chute, it will be understood, has not been set in place. When a chute is in position, mostly buried in the ground, the lug on its side, which covers the opening through which the wires are run to the battery, comes just above the surface of the ground. When a cover is put on a chute, it is automatically locked; and it can be unlocked only by the lifting of the rack (elevator) which holds the jars. The crank by which this lifting is effected is removable, and thus constitutes the key for unlocking the chute. To signal officers who have had padlocks broken, and zincs and copper wires stolen from battery chutes, this feature will need no recommendation.

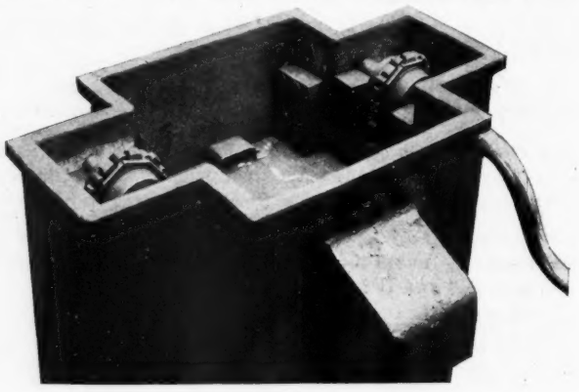


Fig. 1—Lacroix Battery Chute.

It has been found that the counterbalacing of a battery can be readily adjusted so that the jars can be stopped at any position in their upward course, and that they will remain in position without fastening; and that therefore the batteryman will never need an assistant to hold the elevator in place while he does his work or while removing a jar. The danger of breaking jars by careless dropping of the elevator is also obviated.

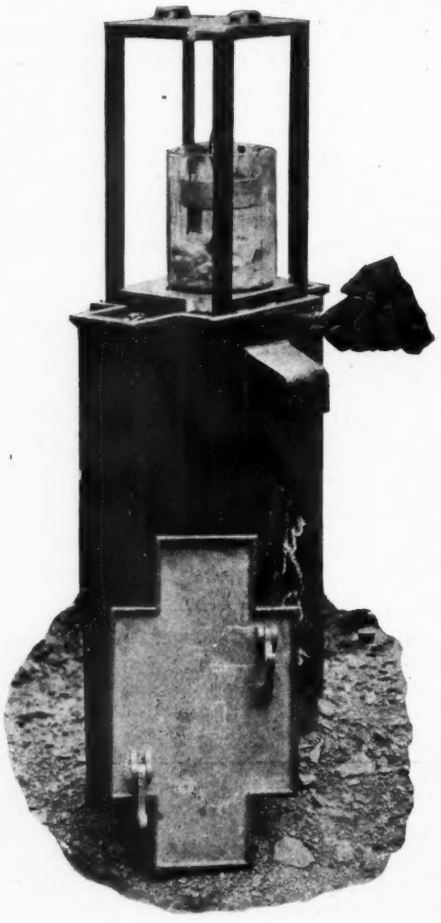


Fig. 2.

Shop Equipment.

Shop Window Sash Operator.

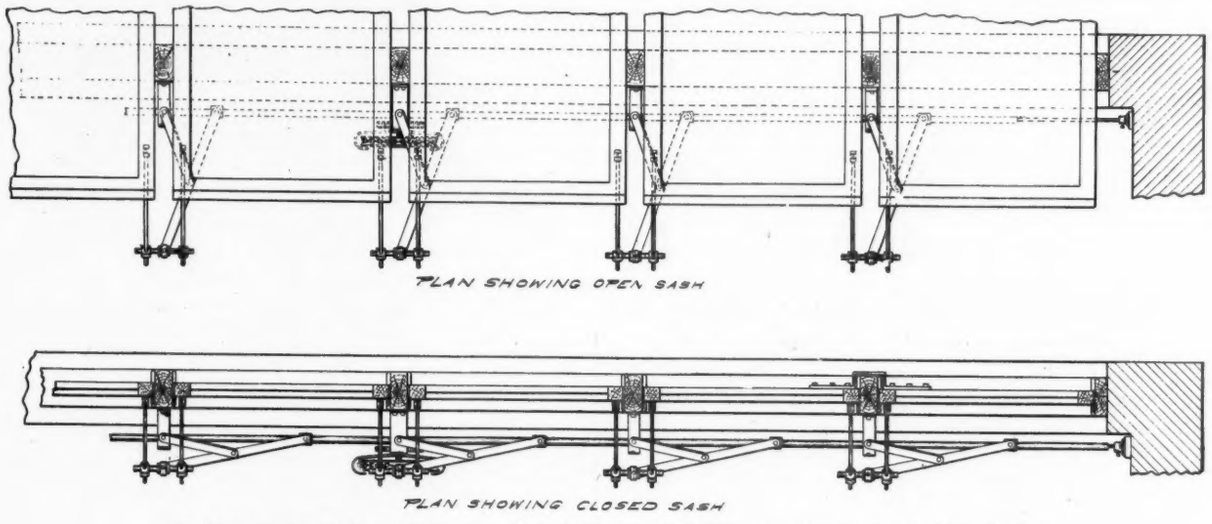
Pivoted windows in shops are not always made to fit their frames without binding and changes of weather and swelling of the wood often make the use of a chisel and hammer necessary to open them. The G. Drouvé Company, Bridgeport, Conn., which has been manufacturing and installing sash operating devices for a number of years, has designed a new sash operating device known as the "Straight Push" operator. It is simple, substantial and as nearly "fool proof" as it is possible to make it.

The direct pushing outward of the sash with two half-inch steel rods, one arm being fastened to each side of the sash at the lower part of side rail, opens the window. These two arms are adjustable to give a 30-deg. or 45-deg. opening. A line of ¾-in. pipe shaft, to which is fastened the main lever at each sash with an open coupling, is moved backwards and forwards between spool roller brackets secured at each column between the windows. A rack and pinion with a geared wheel, controlled by chain from the floor, gives the forward and return movement.

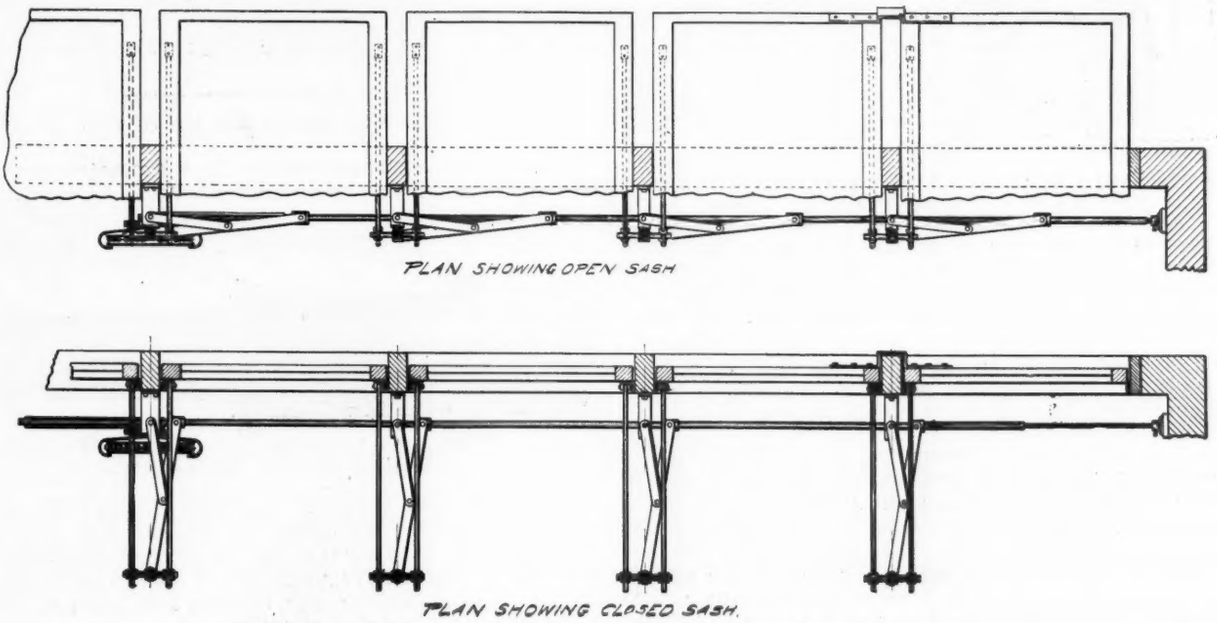
A guide lever is secured to the top of each bracket and in turn is fastened to the main lever. One end of the main lever has a U-chair riveted to it which supports the shaft connecting the two steel arms. While the arms bind to the connecting shaft it works freely in the U-chair support, allowing the arms to follow the inclination of the sash. The movement back or forth of the main shaft operates the levers at each window and as all arms work simultaneously the windows open or close quickly and surely, and each window has the same power applied. As no lost motion occurs the farthest window on the line operates in unison with the first. Several different sizes of wheels are made which give the increased power required as the number of sash to be operated is increased. Any number from 10 to 100 or more sash are easily placed under one control with this operator.

The construction is substantial and the few connecting couplings are simple and of sufficient strength to withstand strain as well as to resist the corrosive effects of gas and acid fumes. The apparatus is adapted to operate pivoted side or pivoted top-and-bottom sash, hinged-at-the-top or hinged-at-bottom sash. The operating parts which are very few cannot rust together as the connections are phosphor bronze-to-iron.

The device is also adapted for unusual conditions that are sometimes met with, as, for instance, where the crane, while not interfering with the hinged or pivoted sash when opened, interferes with the placing of any brackets or parts of an operating device at the normal position of such. Instead of pushing the sash outward from the bottom the sash are pulled inward from the top and are pushed closed. In



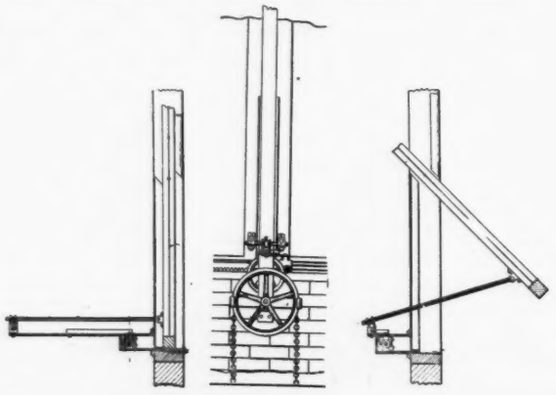
Device Arranged for Pulling in the Sash at the Top to Clear Traveling Crane.



Device as Arranged for Pushing Out the Sash from the Bottom.

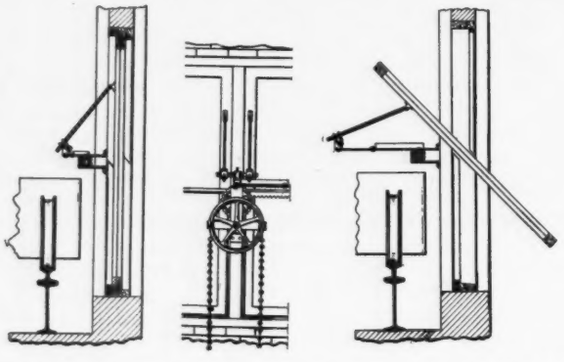
a monitor or lantern construction, where ordinarily it would be necessary to bring the operating chain down the underside slope of the roof and then to the floor, by reason of the numbers of sash that can be controlled from one point, the operating wheel may be placed at the end of the building, the chain coming down the end wall, thus giving a direct control from the floor.

Idlers or pulleys can be used to make corners and with the power being applied only after the wheel sets the rack and pinion in motion, is more direct, easier and quicker to operate than with a torsion shaft. The sash can be opened as much



Closed and Open Position of the Sash Arranged to be Pushed Out from the Bottom.

as may be required for proper ventilation and held at any position. The straight arms act as a brace against wind pressure. Fire drafts may be checked at once by the quick closing of sash made possible with this type of operator. The same holds good in case of a sudden rain or dust storm. The weakest point of this operator is the chain, which controls the operating wheel. This is heavy enough to operate any number of sash that may be put on the line and to stand a reasonable strain, yet will part under an abnormal weight. It is an easy matter to connect a pulled apart link connection



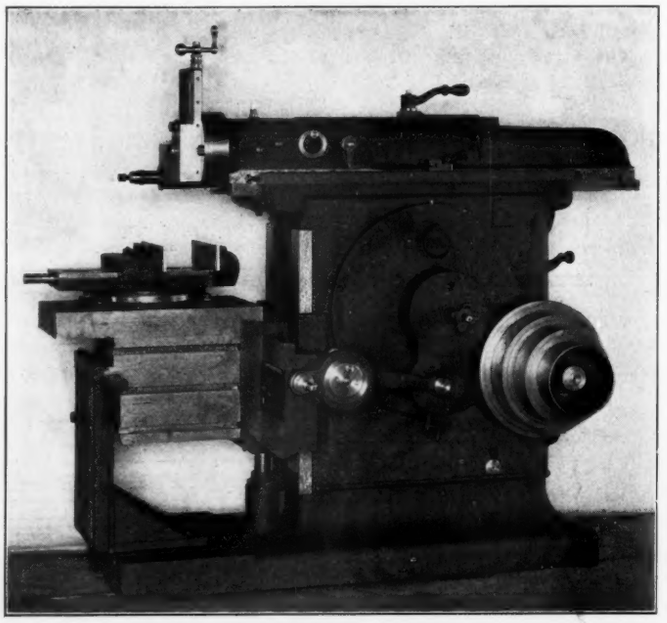
Closed and Open Position of the Sash Arranged to be Pulled in from the Top to Clear Traveling Crane.

and replace the chain over the wheel. This will direct attention to the trouble and it can be remedied, the offending binding window or windows being dropped off the line until such time as they can be planed by the carpenter. The working parts of the apparatus will therefore not be broken and the windows will not all be put out of commission.

Stockbridge 24-Inch Shaper.

A number of changes have been made in the construction of the new 24-in. Stockbridge shaper with the idea of simplifying it and making it stronger. The taper packing, formerly used for taking up the wear of the side thrust of the ram, has been replaced by a solid gib which is bolted to the column and is adjusted by screws. This provides practically a solid face on both sides of the ram. The feed rod of the cross-feed mechanism adjusts itself to any position of the bar, and, without changing its position, feeds the table in either direction and automatically stops at either end of its feed.

The driving cone is carried on a sleeve that is supported by a large self-oiling bearing which takes all strain of the driving cone off the driving shaft and permits the using of a very large bearing. This, in connection with the self-oiling feature prevents the box becoming hot. The direct drive gear ratio is 6 to 1; the back gear ratio is 30 to 1. The ram has eight changes in speed, the number of strokes varying from 8 to 90 per minute. The change gears are all made of steel. The driving shafts are carried through on both sides of machine, giving a bearing at either end. The shafts run in self-oiling



Stockbridge 24-Inch Crank Shaper.

boxes. The shaper may be equipped with a gear box and a single pulley drive, the parts being interchangeable.

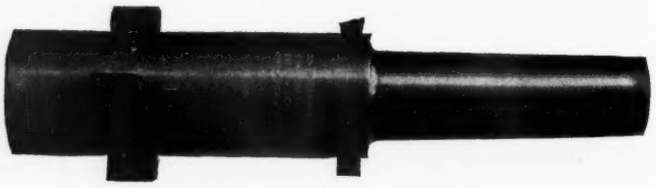
The principal dimensions are:

Actual length of stroke	24¾ in.
Vertical traverse of table	15 "
Horizontal traverse of table	30 "
Top of table	16 x 24 "
Length of ram bearing in column	36 "
Width of ram bearing in column	12 "
Net weight of machine	4,400 lbs.
Floor space required	102 x 52 in.

The shaper is equipped with the Stockbridge patented two-piece-crank motion, which gives an even cutting speed the entire length of cut, together with a quick return. It is manufactured by the Stockbridge Machine Company, Worcester, Mass.

Expansion Boring Bar for Wheels.

Boring mills equipped with the Buck expansion boring bar are finishing from 70 to 80 steel wheels in 10 hours. It is claimed that a steel wheel can be bored complete in five minutes and a cast iron one in still less time. One set of steel



Buck Expansion Boring Bar.

cutters have been known to bore 2,000 wheels. The bar has four cutters which are expanded separately and may be adjusted to divide the metal to be removed into four parts, thus requiring a comparatively light cut of each cutter and adding to the life of the cutting edge, insuring a standard size hole.

The bar was designed to take the roughing and finishing cuts separately—the finishing cutters being slipped out while

the roughing cut was being taken and slipped back into place at its completion. This change may be made so quickly that the time for the complete job is greatly reduced as compared to that ordinarily required. The roughing and finishing cuts may, however, be taken at the same time. The cutters are readily fitted to the bar, requiring no machine work. As they

End View of Expansion Boring Bar.

are expanded separately it is not necessary for them to be of exactly the same length; this feature also permits the tools to be used down to a short length, effecting a considerable saving in the cost of tool steel. The clearance of the cutters is such that they bore a smooth hole and there is no tendency toward springing the bar and boring out of center. A chamfering tool is included at the upper part of the bar, as shown.

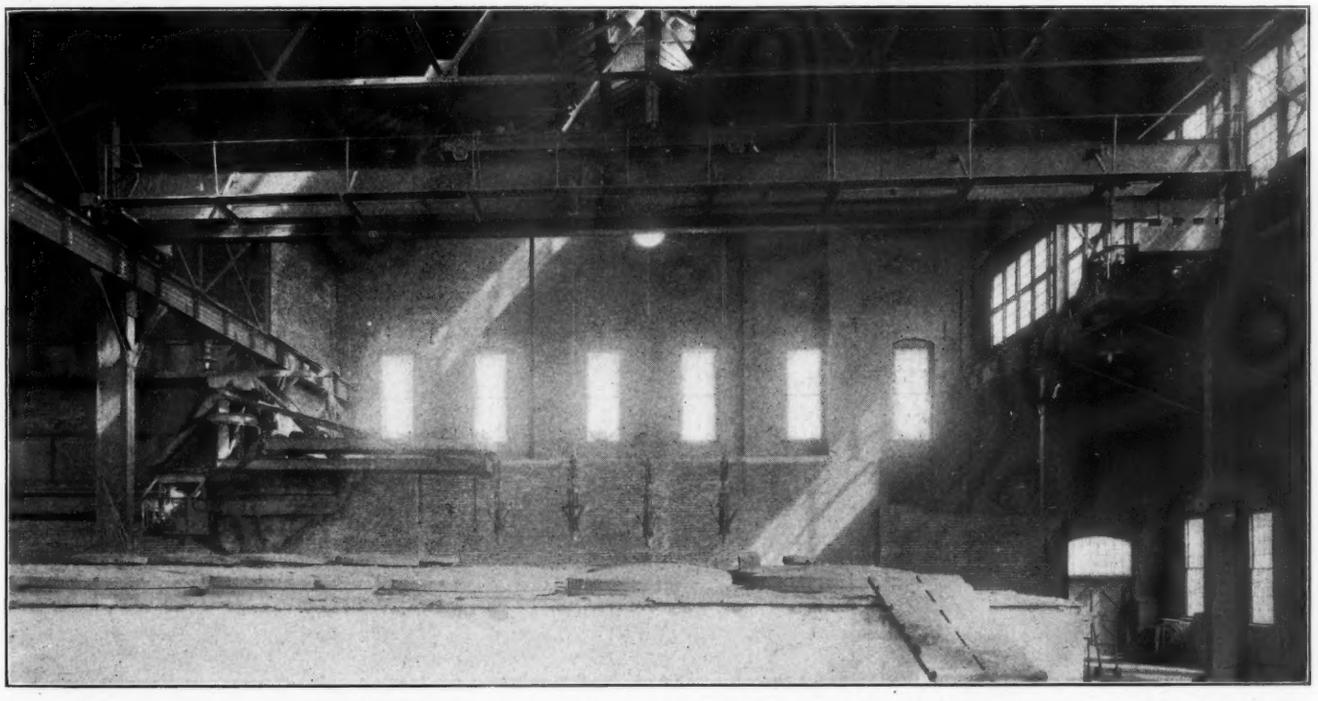
A water attachment applies a small stream direct to the point of the cutting tool, keeping the cutters cool and allowing the machine to be run at a high speed. This water is applied through the bar; there is no piping around the machine to be in the way of the operator. To adjust the cutters to bore the size of hole required, a gage the full width of cutters is used; it is placed over the cutters and they are expanded to the gage. This is found to be more correct than to graduate the expansion adjustment, for in graduating the adjustment the cutters must be kept ground square and of exactly the same length; every time they are reground they become shorter, requiring readjustment. The cutters have a 2-in. range of expansion and one bar will thus answer for wheels with two Master Car Builders standard sizes of bore. The bar is made short and can be used in connection with any make of boring mill. In railway shops, where the work is largely fitting, the bar will be found a great time saver because of its ready adjustment. It is manufactured by the Buck Boring Bar Company, Huntington, W. Va.

Crane Service in the Foundry.

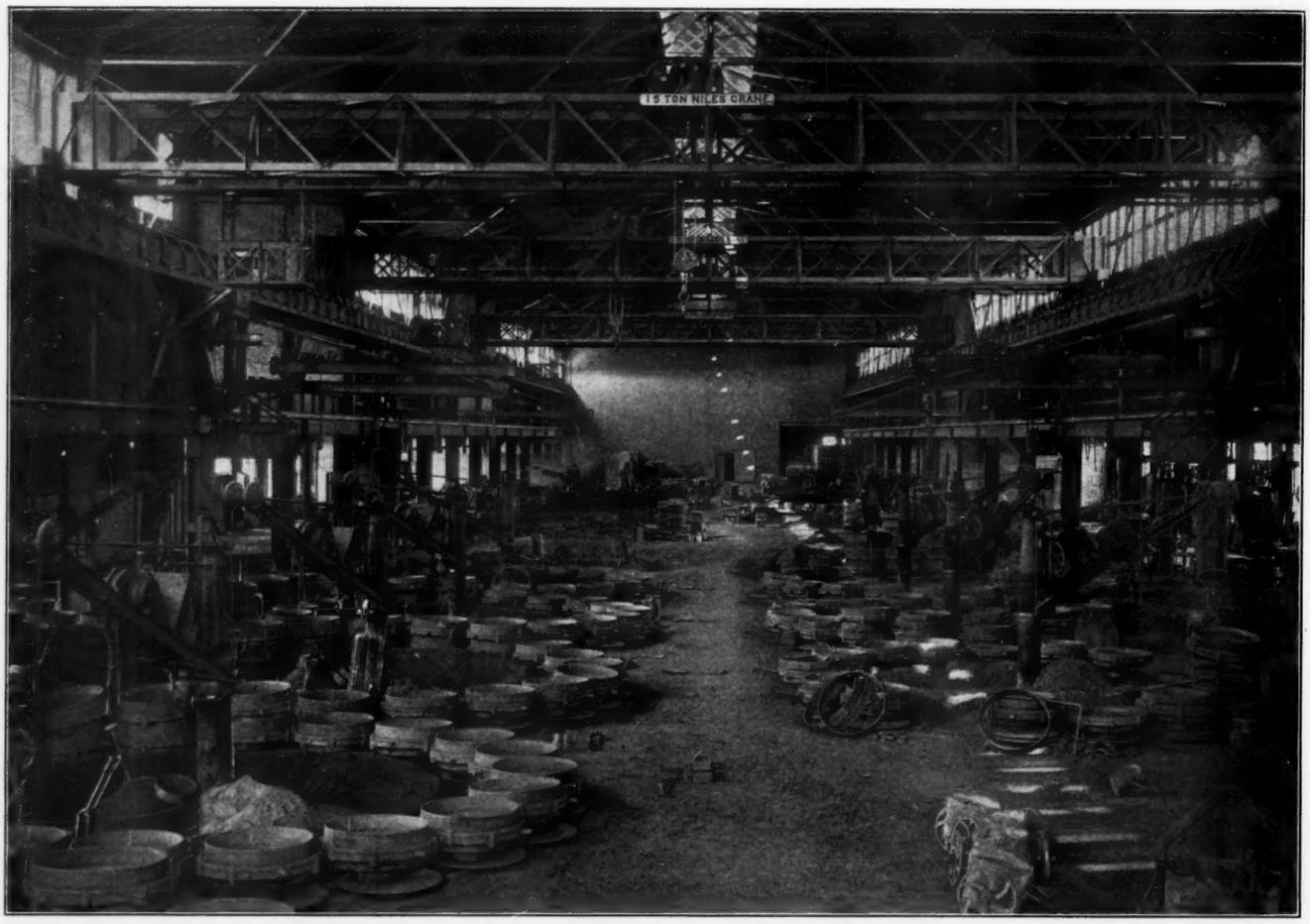
Good crane service is of the greatest importance in improving the efficiency and increasing the output of a railway foundry. An excellent example of a well-equipped plant in this respect is that of the Norfolk & Western at Roanoke, Va., which was described by George L. Fowler in the *Railway Age Gazette* of July 16, July 23 and November 12, 1909. A general view of the wheel foundry is shown in one of the accompanying illustrations. It is equipped with three Niles traveling cranes, each of 15 tons capacity and having a span of 86 ft. 8½ in. They are of the three-motor type, but high speed auxiliary hoists may be attached at any time, if desired. Ample head room has permitted the use of girders, of latticed construction, thus obtaining maximum strength and rigidity, with minimum weight.

The molding floors are in circular form, served by specially designed gib cranes, each one of which serves 17 molds. These gib cranes are of the simple post design, and were illustrated and described in detail in the November 12, 1909, issue, page 929. The boom is 11 ft. in length, and the hoist is operated by a two-cylinder reciprocating air engine.

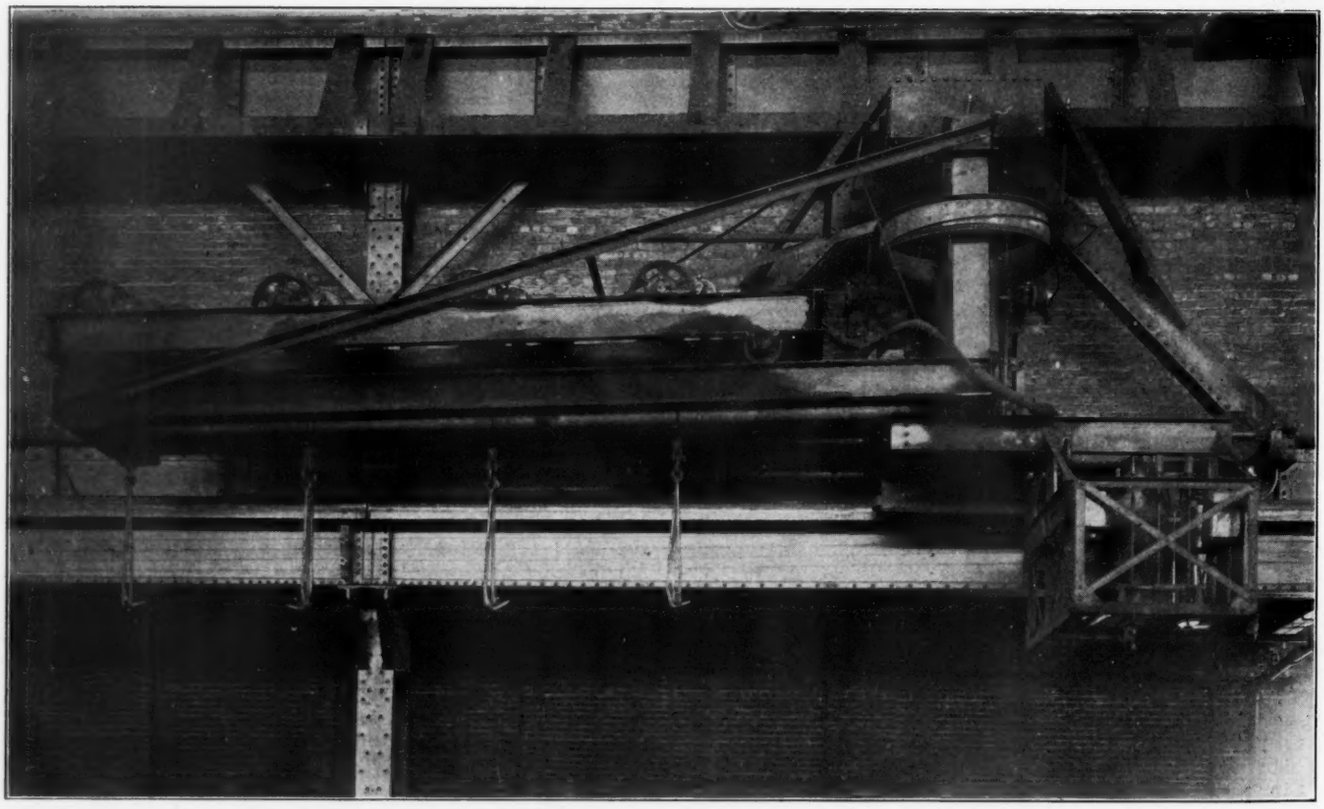
In addition to the overhead traveling cranes and the gib cranes there are two Niles traveling wall cranes on each side of the foundry; these are two-ton capacity each, with a 25-ft. reach, and operate on tracks extending the entire length of the building on both sides. Two of them, one on each side, are of the rigid or stationary arm type, and are equipped with a single hoist and operated by three independent motors. On the other two wall cranes, one of which is shown in detail, the arm or gib is of the revolving type and is geared to operate by power through an arc of 90 degrees. The revolving arm cranes are each equipped with four hoists, as shown, having hooks for picking up the wheels. Each hoist is operated by an independent hoisting mechanism, equipped with a Niles double disc lead brake and independent motors. A special master controller is located in the cage attached to the crane, and is so arranged that any one of the four hoists may be operated independently, or they may all be operated in unison. These cranes each carry four wheels at a time from the mold-



Niles Traveling Crane over the Annealing Pits, Revolving Arm Wall Crane in the Rear; Norfolk & Western Wheel Foundry.



Wheel Foundry of the Norfolk & Western at Roanoke, Va.

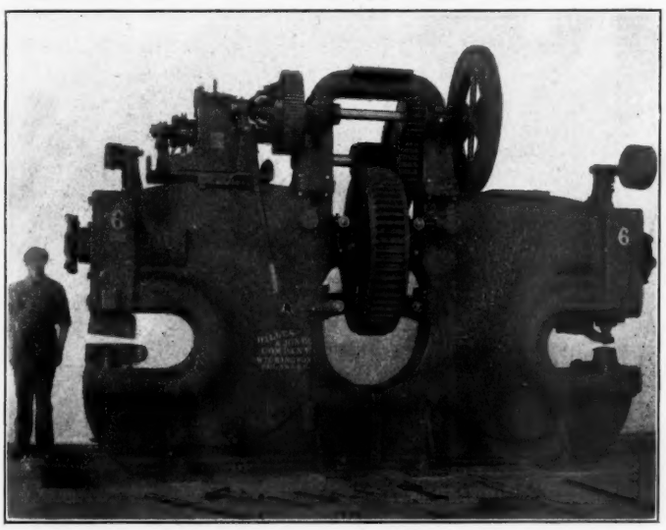


Niles Wall Crane with Revolving Arm; Norfolk & Western Car Wheel Foundry.

ing floor to the annealing pits; the pits are located at the end of the foundry in an addition at right angles to the main building. The wheels are deposited on the floor and are picked up and placed in the pits by an overhead Niles traveling crane equipped with four hoists, also illustrated. This same crane is used for removing the wheels from the pits, four at a time, and transferring them to the cleaning department. The Niles cranes were furnished by the Niles-Bement-Pond Company, New York.

Boiler Shop Tools.

The Hilles & Jones Company, Wilmington, Del., has recently supplied to the Salt Lake shops of the Denver & Rio Grande a number of unusually heavy tools for boiler shop work. The double punch and shear, here illustrated, has an 18-in. throat on each side and is driven by a 25-h.p. motor. One end of the machine is fitted with a punching attachment, the capacity being equal to punching a 3-in. hole in a 1½ in. thickness of steel. The shearing end has a capacity for shearing 2 x 10-in. flat bars. The machine is double geared, both driving shafts being carried in split babbitted bearings, with



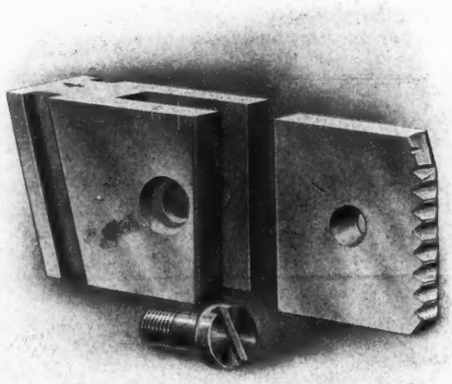
Double Punch and Shear, Hilles & Jones Company.

caps set at an angle so that the shafts can be rolled out of position if necessary without disturbing the bearing keys.

Another machine for the same company is the large bending roll, also illustrated. This tool has rolls 12 ft. 2 in. between housings; the diameter of the upper roll is 19 in., and of each of the lower rolls 14 in. The lower rolls are driven by a 40-h.p. motor, supplied with a reversing controller. The upper roll is raised and lowered independently by a 10-h.p. motor. These motors are placed on the gearing bed, which is separate from the roll housing, as will be seen in the illustration. The rolls are made of forged steel; the top one has a solid extension for counterbalancing, and the housing is hinged for removing plates rolled to full circle.

National Interchangeable Case Die.

The resharpening or regrinding of the cutting edge of dies used in bolt cutters soon reduces the size of the steel and unfits it for further service. The renewal of these cutters has always been the main item in the cost of keeping up bolt threading machinery. Tool holders have been provided for lathes in order to reduce the cost of the steel in the cutting



National Interchangeable Case Die.

tool; with the same purpose of economy in mind and a view to eliminating the express charges to and from the factory, which have heretofore been required by the National plain case die and other types, the new National interchangeable case die has been devised for use where standard sizes are used.

The new case die is made of a special grade of steel and is hardened, as is also the holding screw, making these parts indestructible. They are ground to gages, insuring accurate contact with the head slots and forming a perfect seat for the chaser, thus eliminating lost motion in the dies. The chaser extends the full width of the case, permitting of 20 per cent. more resharpening than is usually secured. The wider chaser also gives more bearing on the work, which further insures the maintenance of correct pitch. The chaser also requires approximately 30 per cent. less cutting steel than other dies. The sum of all these advantages is that most troubles from dies are overcome and 30 to 50 per cent. in bolt cutter up-keep is saved. These improved case dies and chasers are made by the National Machinery Co., Tiffin, Ohio.

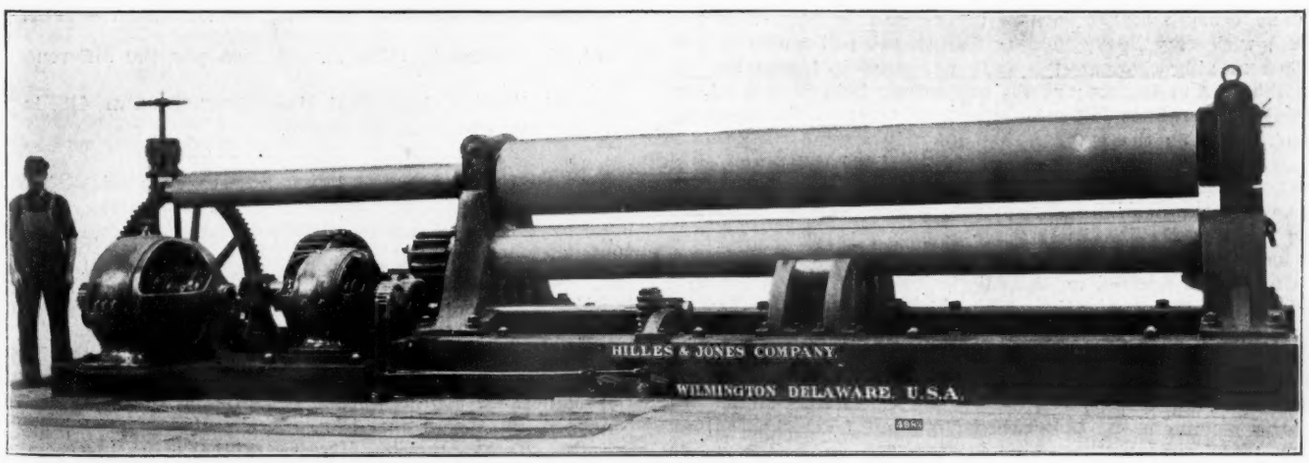
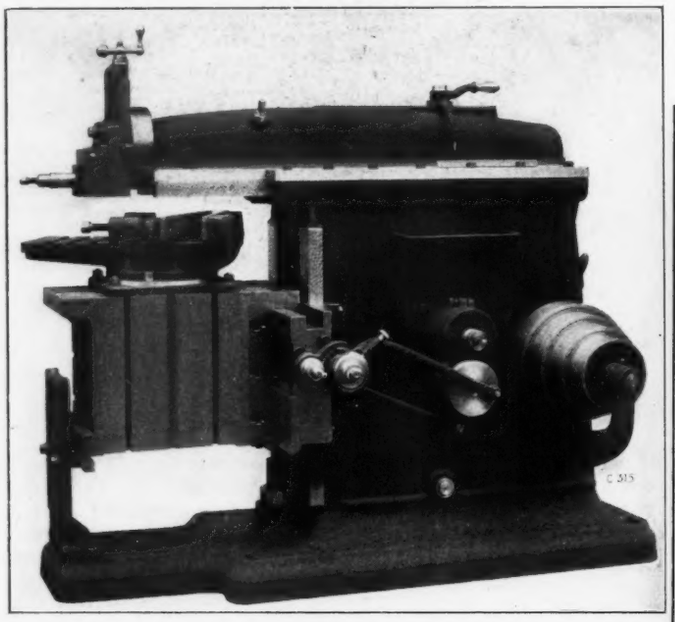


Plate Bending Rolls, Hilles & Jones Company.

24-Inch Queen City Shaper.

Several improvements have recently been made in the 24-in. shaper of the Queen City Machine Tool Company, Cincinnati, Ohio. These will shortly be added to the other sizes. The automatic feed has sixteen changes, from 1-128 to ⅛ in. on the 16 and 20-in., and from 1-64 to ¼ in. on the 24 in. The changes from zero to full feed or reverse, or to and from any number of notches in either direction, may be made instantly while the machine is in operation by means of the cam at the end of the cross traverse screw. To keep the feed on the return stroke, lift the plunger out with the lever on the feed rod and it will travel automatically to the opposite side of the plate and drop into a hole. The changes may be made very rapidly and without danger to the fingers. The feed and distance rods act automatically as the height of the rail is changed. The friction device provides for the transmitting of sufficient power for the feed but not enough to break any of



Queen City 24-Inch Crank Shaper.

the parts if the operator allows the saddle nut to strike against the rail at either end.

The bull wheel bearing is a large bushing that is a press fit in the column, and is also held by four large cap screws. The column is strongly braced at this point. The stem of the bull wheel is of large diameter, with a fillet at the flange, and extends well out from the column, making a balanced bearing with a minimum overhang; a double bearing here is bad practice, as the two diameters will not wear evenly; a double bull wheel merely increases the overhang, without adequate advantage. The length of stroke may be set while the machine is in motion or at rest.

The bearing of the rail on the column is long, wide and deep, with very heavy holding clamps the full width of rail. When making changes it is only necessary to loosen the nut on the stud at the top; as the cap screws hold it to a sliding fit, the rail cannot fall away from the column; the elevating shaft being on the reverse side one trip around the table is saved each time, and it cannot be confused with the cross traverse screw. The elevating screw works in a sleeve, and a hole in the floor is not required; a ball bearing minimizes the friction; the bevel gears are of proper ratio and are protected from chips and dirt.

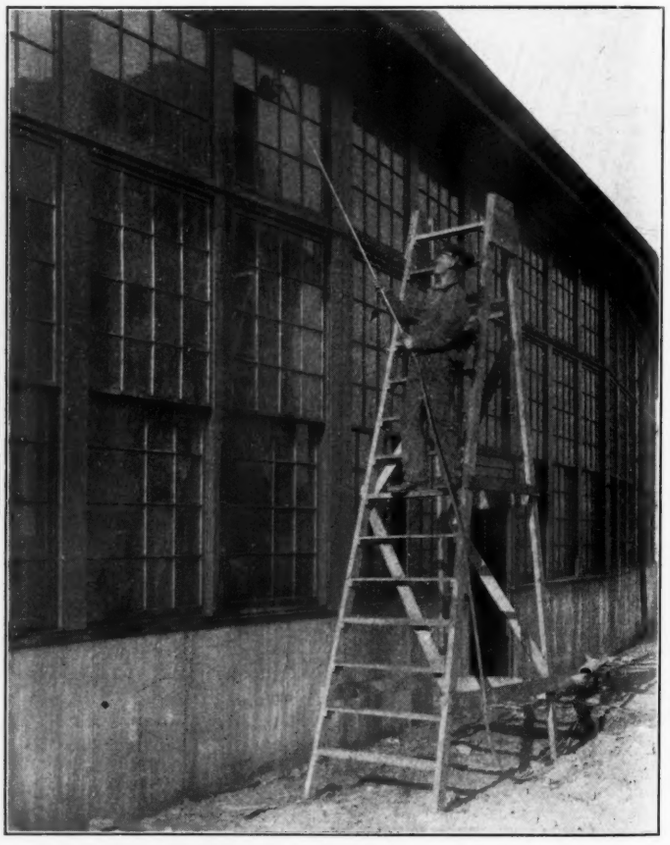
The saddle bearing on the rail is long and very wide both on top and the front; the wedge gib at the top provides for easy adjustment; the clamp at the bottom prevents tipping. The V connection of the table to the saddle makes a rigid construction, and provides for instant return to former alinement if removed; it is also held to the saddle by T-bolts. All of the T-slots in the table are equidistant from the centers. The table support has full adjustments and it is made self-adjusting.

Stanton Coach and Window Washer.

A number of railways have recently installed a new window washer which is said to show a marked economy over the old methods. The device consists of a bristle brush through which water is sprayed by a patent sprayer, the brush and sprayer being attached to a cold-drawn steel tube handle which is connected at its lower end to a hose from the hot or cold water supply. The amount of water used can be accurately controlled by a ground valve at the lower end of the handle, so that the operator can flush the surface being washed or merely dampen it.

The brushes are bristle, copper tied. In regular service at the Wabash roundhouse in Decatur, Ill., a single brush washed about 1,000,000 sq. ft. of glass. The handles, being made of steel, should have a long life. A patent goose neck is used to prevent water from running down the handle to the hands of the operator.

Since the water comes through the brush continuously and there is no stopping to dip the brush, it is claimed that one man, with the Stanton cleaner, can easily do the work of two men with the old method. As the cost of the device is not



Roundhouse Window Washing with Stanton Washer.

great, the saving in labor should soon pay the difference in cost.

Geo. R. Stanton, 1302 West Main street, Decatur, Ill., is the inventor and owner of the device.

To show the tendency of things in Russia an official journal publishes the following statement of the new railway mileage built by the State and by private corporations from 1903 to 1907, both inclusive:

	State.	Private.		State.	Private.
1903.....	3,343	723	1906.....	1,247	462
1904.....	3,163	685	1907.....	1,229	53
1905.....	2,608	611			

But at the beginning of 1909 authority had been issued for the state to build 1,407 miles and for companies to build 1,643 miles. Moreover, all but 146 miles of the State railway consisted of the Amur Railroad, in the extreme east of Siberia, so that the building of railways in Russia seems again to be left to private enterprise.